

Biodiversity Offset Plan

Dulacca Renewable Energy Project

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Date 03-Jun-2021

Prepared by Liz Fisher

Reviewed by Chris Todd

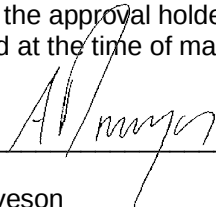
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			Name/Position	Signature
0	13-Nov-2019	Final for lodgement	Chris Adamson – Principal Environmental Planner	
1	23-Mar-2020	Updated in response to DAWE comments	Chris Adamson – Principal Environmental Planner	
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4	03-Jun-2021	Updated in response to DAWE comments	Chris Adamson Principal Environmental Planner	

Declaration of accuracy

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Signed:



Full name (please print):

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Organisation and position (please print): Director

Dulacca Energy Project Co Pty Ltd as a trustee for the
Dulacca Energy Project Trust

Date:

03 / 06 / 2021

Table of Contents

1.0	Introduction	1
1.1	Background	1
1.2	Purpose of the BOP	1
1.3	Dulacca Renewable Energy Project	4
1.4	Significant residual impacts	5
2.0	Hermitage Property Offset Area	2
2.1	Property location and regional context	2
2.2	Tenure and ownership	2
2.3	Offset area	2
2.4	Historical land use	2
2.5	Current land use	4
2.6	Offset values	4
	2.6.1 Vegetation community	4
	2.6.2 Habitat values	5
	2.6.3 Dulacca Woodland Snail habitat	5
2.7	Landscape values	6
2.8	Threatening processes	6
3.0	Offset Suitability	9
3.1	OAG assessment	9
	3.1.1 Impact site	9
	3.1.2 Offset area	9
3.2	Compliance with offset principles	12
4.0	Offset Management Plan	15
4.1	Offset management objectives and outcomes	15
4.2	Offset management strategies	16
	4.2.1 Stock management	17
	4.2.2 Natural regeneration	18
	4.2.3 Integrated weed, pest and herbivore management	19
	4.2.4 Fire risk management	21
4.3	Offset management risks	21
4.4	Offset security	22
5.0	Monitoring & Reporting	24
5.1	Monitoring	24
5.2	Reporting	25
6.0	Offset implementation schedule	27
6.1	Implementation strategy	27
6.2	BOP review	27
7.0	References	32
Appendix A		
	Condition data and scores	A
Appendix B		
	Fauna Survey Report	B
Appendix C		
	Modelled offset quality scenarios	C
Appendix D		
	Weed treatment and control methods	D
Appendix E		
	Definitions from EPBC Act Approval	E

Glossary

AECOM	AECOM Australia Pty Ltd
BOP	Biodiversity Offset Plan
cm	Centimetre
CWD	Coarse woody debris
DAF	Department of Agriculture and Fisheries (Qld)
DAWE	Department of Agriculture, Water and the Environment (Cth)
EOP	EPBC Act Environmental Offsets Policy (Cth)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>
EPBC Act Approval	Approval issued by DAWE on 21 August 2020 (Ref. EPBC 2018/8368)
ha	Hectare
km	Kilometre
kV	Kilovolt
L	Litre
LGA	Local Government Area
MNES	Matters of National Environmental Significance
MW	Megawatt
NEM	National Electricity Market
OAG	EPBC Act Offsets Assessment Guide
Project	Dulacca Renewable Energy Project
REs	Regional Ecosystems
RES	RES Australia Pty Ltd
SLATS	Queensland Government's State-wide Landcover and Trees Study
Vdec	Voluntary Declaration under the VM Act
VM Act	<i>Vegetation Management Act 1999 (Qld)</i>

1.0 Introduction

1.1 Background

The Dulacca Renewable Energy Project (the Project) is located approximately 7 km to the east of the township of Dulacca in the Western Downs region of southern Queensland. It is wholly contained within the Western Downs Local Government Area (LGA) (Figure 1). The Project will involve the construction and operation of a wind farm consisting of 43 wind turbines and associated infrastructure generating approximately 180 MW of clean, renewable electricity from the power of the wind resources at the site. The project approval additionally supports the construction of an energy storage facility which may be progressed as a second phase of the project independent to the construction of the wind farm.

An assessment of environmental values, including the presence of Matters of National Environmental Significance (MNES) has been completed for the Project (AECOM, 2018). Following the evaluation of anticipated project impacts, the Project was referred to the Commonwealth Department of Agriculture, Water and the Environment (DAWE). The Project was deemed a 'controlled action' requiring further assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) via Preliminary Documentation.

The prepared Preliminary Documentation for the Project identified significant residual impacts on MNES as a result of the Project, namely Dulacca Woodland Snail (*Adclarkia dulacca*) habitat. As per Part 9 of the EPBC Act and the EPBC Act Environmental Offset Policy 2012 (EOP), unavoidable significant residual impacts require the delivery of offsets. The provision of offsets is considered both a feasible and reasonable approach for the Project, which has implemented numerous measures to avoid, minimise and mitigate significant impacts to MNES.

Following assessment of the Preliminary Documentation, the Project was approved with conditions by DAWE under sections 130(1) and 133(1) of the EPBC Act on 21 August 2020 (Ref. EPBC 2018/8368) (the EPBC Act Approval).

The EPBC Act Approval approved the taking of the action with regard to each relevant controlling provision of the EPBC Act, as follows:

- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A).

The EPBC Act Approval includes conditions specific to the action and standard administrative conditions. This document presents a Biodiversity Offset Plan (BOP) that has been prepared to address the Project's offset requirements under the EPBC Act, EPBC Act EOP and the EPBC Act Approval. The Hermitage property has been identified as containing a suitable offset area with the appropriate MNES values that will wholly acquit the Project's offset liabilities.

1.2 Purpose of the BOP

The purpose of the BOP is to detail the offsets that will be delivered to counterbalance the significant residual impacts of the Project. It will ultimately demonstrate compliance with Part 9 of EPBC Act and the EPBC Act Environmental Offset Policy 2012 (EOP) as well as outline the management requirements that will ensure a no net loss of MNES values.

Specifically, the BOP:

- describes the offset property and the Project's offset area, including values, existing condition and threatening processes
- demonstrates the Project's compliance with the Commonwealth EPBC Act EOP including the degree of conservation gain and environmental equivalency
- assesses the offset against the offset requirements for the Project in accordance with the Offsets Assessment Guide (OAG)

- determines the overall suitability of the Project's offset and anticipated environmental outcome
- details the required management, monitoring and reporting actions to achieve the desired conservation outcomes.

In addition, this BOP addresses the relevant conditions of the EPBC Act Approval as shown in Table 1. A bolded term in Table 1 denotes a term that is subject to a formal definition under Part C of the EPBC Act Approval, with the relevant definitions included in Appendix E.

Table 1 EPBC Act Approval conditions

Condition ref.	Relevant conditions requirement	Relevant section of BOP
Conditions 15	To compensate for the clearance of 1.49 ha of Dulacca Woodland Snail habitat , the approval holder must:	N/A
	a. secure a legal agreement with the landowner to protect at least 3 ha of the Hermitage Property Offset area as described in the Biodiversity Offset Plan (BOP) , prior to the commencement of the action . The approval holder must ensure the Hermitage Property Offset area is legally secured within 6 months of the commencement of the action ;	Section 4.4 – Offset security
	b. provide the Department with written evidence demonstrating that the Hermitage Property Offset area has been legally secured , and shapefiles of the offset attributes of the Hermitage Property Offset Area , within 20 business days of legally securing the Hermitage Property Offset area ; and	Section 4.4 – Offset security
	c. allow grazing on the Hermitage Property Offset area only between the months of April and October in any year if and when grass cover exceeds 60% and 850 kg/ha pasture biomass and only allow low to moderate grazing, for the purposes of fuel reduction. To prevent impacts to regeneration, the approval holder must not allow grazing at any other time.	• Section 4.2.1 – Stock management • Section 4.2.2 – Natural regeneration • Table 12 – Offset area implementation strategy
Condition 16	The approval holder must implement the BOP at the Hermitage Property Offset area for the duration of the approval to restore Dulacca Woodland Snail habitat to the BioCondition attribute targets prescribed within the BOP .	• Section 3.2 – Compliance with offset principles • Section 4.1 – Offset management objectives and outcomes • Section 4.4 – Offset security
Condition 17	The approval holder must achieve the following BioCondition attributes across the Hermitage Property Offset area by the end of year 10 and subsequently maintain or exceed these attributes within the benchmark for Regional Ecosystem	Section 4.1 – Offset management objectives and outcomes

Condition ref.	Relevant conditions requirement	Relevant section of BOP
	11.9.1 for the remainder of the period of effect of the approval: a. average recruitment of dominant canopy species greater than 75% of the benchmark for Regional Ecosystem 11.9.1; b. average native plant species richness at >25% to 90% of the benchmark for Regional Ecosystem 11.9.1; c. tree canopy median height of greater than 40% of the benchmark height (>6 m); d. average tree canopy cover >50% or ≤200% of the benchmark for Regional Ecosystem 11.9.1; e. average native perennial grass cover at ≥25% or <50% of the benchmark for Regional Ecosystem 11.9.1; f. non-native plants comprise less than 5% of vegetation cover; g. the abundance of non-native species is no greater than baseline levels; and h. species stocking rate of the Dulacca Woodland Snail increased from baseline by 50% of the modelled quality scenario with offset as described in the BOP.	
Condition 18	The approval holder must engage a suitably qualified ecologist to complete an assessment of the Hermitage Property Offset area within 3 months after the end of each of year 5, year 10, year 15 and year 20. Each assessment must set out the opinion of the suitably qualified ecologist and provide the evidence on which the opinion is based, as to whether the BioCondition attributes specified in the BOP in respect of the particular period (including, for year 10, those required under condition 17) have been achieved and, in respect of subsequent periods, are likely to be achieved. The findings of each assessment must be published on the website within 1 month of completion and provided to the Department within five (5) business days of being published on the website.	- Section 5.0 – Monitoring and Reporting - Section 6.0 – Offset implementation schedule
Condition 19	If any of the BioCondition attributes specified in the BOP and under condition 17 in respect of Year 10 have not been met at the end of Year 10, or the suitably qualified ecologist has advised that any BioCondition attributes required for the subsequent periods is not likely to be achieved by the end of Year 10, the approval	Section 6.2 – BOP review

Condition ref.	Relevant conditions requirement	Relevant section of BOP
	holder must, within 6 months of the end of Year 10, submit a revised version of the BOP to the Department for the Minister's approval, revised on the advice of the suitably qualified ecologist and including: a. details of the potential or actual cause(s) of the non-achievement of required BioCondition attributes; b. details of the corrective action/s that the approval holder commits to undertake in order to achieve all outstanding BioCondition attributes; c. an assessment of the likely effectiveness of the proposed corrective action/s; d. proposed timeframes for reporting to the Department the results of implementing of the corrective actions; and e. contingency measures that will be implemented if monitoring suggests that the corrective action/s are not being effective.	
Condition 20	If a revised version of the BOP has not been approved by the Minister within 12 months of the end of Year 10 , the approval holder must cease the action until a revised version of the BOP is approved by the Minister .	Section 6.2 – BOP review

1.3 Dulacca Renewable Energy Project

The Project is a wind farm development proposed by RES Australia Pty Ltd (RES). RES is the Construction Management and Asset Management lead for the Project and is responsible for ensuring the relevant commercial, quality, health, safety and environmental (HSE) objectives and compliance obligations are achieved.

The Project is proposed over 21 lots (comprising six landowners) and numerous road reserves, totalling 8,177 ha (the Study Area) (Figure 1). The Study Area is bisected by the Warrego Highway and Western Rail Line which run parallel to each other. Waituna Road and several unformed road reserves and access tracks also bisect the Study Area. The Project is in a highly cleared and fragmented landscape, where much of the original vegetation and habitat has been removed for agricultural purposes. Surrounding properties that adjoin the Project Area are primarily of freehold tenure and mainly consist of agricultural uses.

In addition to the construction of 43 wind turbines, the Project will include the construction of supporting and ancillary infrastructure including a substation, operational and maintenance facilities, three meteorology masts, construction compounds and laydown areas, foundations and hardstand areas, access tracks and cabling (overhead lines and underground cabling). The Project will connect to the National Energy Market (NEM) via two adjacent 132 kilovolt (kV) transmission lines which traverse the Study Area. Each wind turbine will be connected by underground or over ground cables to a purpose-built substation that will be constructed adjacent to the existing transmission lines.

The Project layout and design has sought to avoid and minimise impacts wherever possible and as such the proposed disturbance footprint has been significantly reduced from original concept designs. The disturbance footprint has been informed by RES and Vestas having regard to Project and site-

specific construction and operational considerations. Overall, the Project will involve a disturbance footprint of approximately 292 ha (Figure 1).

1.4 Significant residual impacts

The Project was deemed a controlled action by DAWE for the following relevant controlling provisions:

- listed threatened species and communities (sections 18 and 18A)
- listed migratory species (sections 20 and 20A).

The prepared Preliminary Documentation has further assessed project impacts on the above controlling provisions. Significant impacts as defined under the EPBC Act Significant Impact Guidelines have been identified for only one listed species, Dulacca Woodland Snail. The Dulacca Woodland Snail is listed as endangered under the EPBC Act.

A significant population of this species and approximately 765.2 ha of suitable habitat has been confirmed within the Study Area. Project impacts to the species are anticipated during all phases (pre-construction, construction, operation, decommissioning and rehabilitation) and include:

- loss of individuals in the order of <20 individuals during clearing activities
- loss of habitat and microhabitat features with maximum impact determined to be 1.49 ha
- fragmentation of existing habitat and creation of barriers to species movement through clearing widths for infrastructure corridors (i.e. transmission line)
- potential proliferations of Buffel Grass (*Cenchrus ciliaris*) within edges of existing habitat causing habitat modification and degradation
- increased potential of fire and subsequent habitat destruction and mortality of the species due to increase in Buffel Grass incursion.

Avoidance and mitigation measures will and have been implemented to manage the identified impacts to this species; however residual impacts will remain, which trigger the following significant impact criteria:

- long-term decrease in the size of a local population
- fragmentation of an existing population
- interference with the recovery of the species
- disruption to ecologically significant locations (breeding, feeding, nesting, migrating or resting sites) for the species.

The total residual risk to the species in terms of the area impacted has been calculated at a total of 1.49 ha (Figure 1).

The significant residual impacts to the Dulacca Woodland Snail have been determined having regard to the likely and worst-case disturbance anticipated by the construction, operation and decommissioning of the Project. The area of the disturbance footprint provides the Project with a level of flexibility through detailed design whilst ensuring certainty of impacts to the species. As such, further micro-siting during detailed design phase will not increase overall disturbance to Dulacca Woodland Snail habitat above the upper limits of 1.49 ha.

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DATUM GDA 1994, PROJECTION MGA ZONE 55

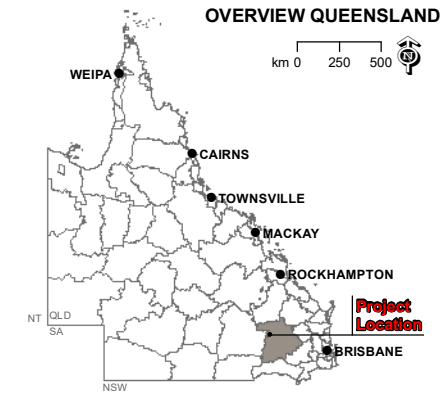
0 1 2
Kilometres

1 cm = 650 m (when printed @ A3)

Legend

- Study Area (8,177 ha)
- Disturbance Footprint
- Highway
- Other roads
- Dulacca Snail Significant Residual Impact (1.49 ha)
- Wind Turbine

OVERVIEW QUEENSLAND



1. Site layout elements © RES, 2019
2. Local Government Areas © State of Queensland (Department of Natural Resources and Mines) 2017
3. Place names gazetteer - Queensland © State of Queensland (Department of Natural Resources and Mines) 2017
4. Baseline roads and tracks Queensland © State of Queensland (Department of Natural Resources and Mines) 2017
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DULACCA RENEWABLE ENERGY PROJECT

DULACCA RENEWABLE ENERGY PROJECT STUDY AREA

PROJECT #: 60567855
CREATED BY: AS
LAST MODIFIED: 16/10/2020
VERSION: 2

Figure
1

2.0 Hermitage Property Offset Area

2.1 Property location and regional context

The Hermitage property occurs both adjacent to, and across the northern portion of the Project's Study Area (Figure 2). The property encompasses a total area of 2,260.85 ha and is within the Southern Brigalow Belt Bioregion, 155 km north-west of Dalby and 235 km north-west of Toowoomba.

The property predominantly consists of cleared pasture land with extant vegetation occurring in both regrowth and remnant condition on a rocky lateritic jump up and sandstone ridge line that bisects the centre of the property on a north-west and south-east alignment. Other remaining areas of vegetation occur as shadelines and isolated patches across the property.

2.2 Tenure and ownership

The property is freehold tenure currently owned by the Nixon family who utilise the property for cattle grazing purposes. No mining, petroleum leases, key resource areas or pipeline easements occur across the property. A granted exploration permit for petroleum activities (ATP631) occurs over the Hermitage Property. The primary holder of the permit is Bronco Energy.

2.3 Offset area

The proposed offset area encompasses 3 ha in the north-western corner of the property and is located 2.4 km west of the Project's Study Area (Figure 2). In terms of access, the offset area is approximately 10 km north of the Warrego Highway on the eastern side of Yapunya Road.

A 10 m setback to either existing, or to internal fence lines constructed to support the proposed offset, will be included as an additional area to the 3 ha proposed offset (Figure 3). This setback will accommodate any required bushfire management measures as well as sufficiently manage any potential indirect impacts associated with edge effects.

The offset comprises of regrowth vegetation and forms the north-western extent of the vegetated ridgeline that bisects the property. As such the offset area is bounded to the east and south by intact vegetation, which will also buffer the offset area. A narrow linear strip of native vegetation within the designated road reserve will also buffer the offset area to the north and west from adjacent cleared paddocks. The property boundary fence flanks the northern and western borders (Figure 2). No other infrastructure occurs within the offset area.

The offset area was chosen and designed based on the following factors considered important in improving the condition and viability of existing habitat for the species:

- Presence of a population of Dulacca Woodland Snail
- Presence of critical habitat features to support the species i.e. leaf litter, fallen woody debris
- Connectivity with surrounding adjacent habitat
- Location and configuration, which enables the area to be appropriately managed to reduce threatening processes.

These factors are further described in the section below.

2.4 Historical land use

Significant development of the Hermitage Property has occurred between the 1950's and 1970's with the majority of vegetation cleared for pastoral activities. The re-clearing of regrowth after the initial development phase is part of the recognised and regionally accepted practice for maintaining a grazing enterprise in Central Queensland and the Brigalow Belt.

In the offset area, initial clearing of the regrowth vegetation is identified from historical photos to have occurred prior to 1956. Since this time, regrowth has been re-cleared and maintained in this condition on an ongoing basis as shown in the historical photo times series from 1956 to 2006 (Plate 1).



Plate 1 Historical aerials depicting condition of offset area

2.5 Current land use

At present, the offset area, along with the remaining Hermitage property is predominantly used for cattle grazing purposes. Development of infrastructure and clearing of vegetation to support the cattle enterprise continues as per the previous historical development cycle.

As per Sections 43A and 43B of the EPBC Act, certain actions are exempt from the assessment and approval provisions of the EPBC Act. They apply to lawful continuations of land use that started before 16 July 2000 or actions that were legally authorised before 16 July 2000, the date of commencement of the EPBC Act. These exemptions allow for the continuation of activities that were fully approved by state and local governments before the EPBC Act came into force ("prior authorisation"), or otherwise lawful, activities, which commenced before the EPBC Act came into force, and which have continued without substantial interruption ("continuing uses"). Clearing activities that have historically been undertaken across the property are therefore permitted to continue to support grazing activities. As demonstrated by the series of historical aerial photos, ongoing clearing has taken place in the offset area since 1956 and will continue under the EPBC Act exemption (Plate 1).

Vegetation within the offset area is also not recognised to be in remnant condition (Category B Regulated Vegetation) and is not protected by State Government legislation from broadscale clearing activities. The regrowth areas are programmed to be re-cleared as per ongoing property maintenance and grazing practices.

2.6 Offset values

2.6.1 Vegetation community

One vegetation community was confirmed within the offset area and can be described as an *Acacia harpophylla* (Brigalow) and *Eucalyptus thozetiana* low open forest, with a canopy height of up to 3m on fine-grained sedimentary rocks (Plate 2). The sub canopy layer is absent and the shrub layer is very sparse consisting primarily of regrowth Brigalow, *Casuarina cristata* (Belah) and *Rhagodia spinescens* (Spiny Ruby Saltbush).

The vegetated ground coverage is very low with only 0.4% average coverage recorded within the community. This consists of native grass species and forbs including *Capparis lasiantha* (Nepine). Exotic vegetation cover was present with Buffel Grass identified but in low abundance with average cover recorded at 0.1%.

The vegetation community is analogous to RE11.9.1 and is in regrowth condition. Recruitment levels of species within the canopy layer were recorded at 100%, which indicates that the community is successfully regenerating. However historical clearing disturbances and ongoing cattle grazing have significantly degraded the structure and floristic diversity of this vegetation community. This is reflected in the results of the site condition assessment undertaken within the area, which score the vegetation community a five out of ten (Appendix A).



Plate 2 Brigalow low open forest community within the offset area

2.6.2 Habitat values

Habitat occurring within the offset area can be classified as one habitat type (Brigalow low open forest) based on vegetation composition, condition and available habitat resources. This habitat was found to have a low structural complexity with only a canopy layer (up 39.2% cover) and very sparse shrub layer (up to 2.1% cover) present. This simplistic structure combined with an immature canopy height limits the value of this habitat in providing sheltering, nesting and dispersal resources and opportunities for bird species and arboreal mammals. No hollow-bearing trees are present within the habitat therefore no breeding resources are available for hollow dependent species including microbats.

Structural complexity within the ground layer is also low. The extent of grass tussocks is minimal in this habitat, which limits the availability of sheltering, breeding and nesting resources for small mammals and reptiles. Rocky areas are also absent and therefore minimal basking opportunities for reptiles are present. However, leaf litter coverage is high (100% in areas) and the extent of fallen woody debris is similar, albeit reduced compared to non-disturbed habitats, which would provide some form of shelter, nesting and breeding habitat for ground-dwelling species.

Floristic diversity within this habitat is low and therefore the abundance of foraging resources to support a variety of fauna species is low. In particular, fruiting and flowering plants and seeding grasses were either absent or in low abundance.

The soil type within this habitat is dominated by clay and shallow gilgai depressions were noted. These areas are considered to be highly ephemeral but would periodically hold water after extended high and extreme rainfall events. During this time aquatic habitat would be provided for a variety of frog species.

Threatening process are noted to be present within this habitat, which continues to degrade its values. These include historical broadscale clearing, fire, cattle grazing, pest species incursion and grazing / trampling by macropods. These threatening processes have significantly degraded the diversity and availability of habitat resources of the Brigalow low open forest habitat. This is reflected in the results of the site condition assessment undertaken within the area, which also score the habitat a five out of ten (Appendix A).



Plate 3 Habitat resources identified within the offset area

2.6.3 Dulacca Woodland Snail habitat

Targeted species surveys undertaken in October 2019 within the proposed offset area identified the presence of Dulacca Woodland Snail. A total of seven dead shells were recorded in the area (Plate 4). The species was also recorded in nearby adjacent habitats to the proposed offset area (Figure 3). Details of targeted species surveys are outlined in the Fauna Survey Report in Appendix B (Boobook 2019).

The Dulacca Woodland Snail preferred habitat is described as vine thicket on rocky outcrops or Brigalow, ironbark (*Eucalyptus* spp.), lancewood (*Acacia shirleyi*) or Gum-topped Box (*Eucalyptus woollsiana*) woodland habitat (TSSC 2016). Within this habitat, the species shelters beneath logs, under rocks, among leaf litter and in loose bark at the base of trees. During periods of inactivity the

Dulacca Woodland Snail will aestivate at its chosen shelter site, attaching to the underside of logs, rock and leaves to conserve moisture. The species also utilises logs, leaf litter and bark to lay eggs and protect from desiccation. Therefore, the presence of microhabitat features is critical to the survival of the species.

Suitable Brigalow habitat for the species was confirmed across the entire offset area. Within the offset area, important microhabitat features for the species such as leaf litter and fallen woody debris are present but at a lower abundance compared to undisturbed communities. The habitat is contiguous with adjacent vegetation providing a corridor to habitat further south, although the lack of consistent coverage within the ground layer limits the movement opportunities for the species.

The habitat within the offset area is considered suitable for breeding, foraging and dispersal by the species and is currently supporting the existing population to this extent. However, existing disturbances within the offset area have reduced the quality of the habitat for the species. The lack of an intact canopy layer within the offset area has likely modified the microclimate of the understorey, making the species more susceptible to desiccation during hot and dry conditions. Impacts of grazing and trampling by feral pigs, cattle and macropods, specifically Black-striped Wallabies, was evident within the offset area from the reduction in grass cover and fallen woody debris.

As a result, the species habitat index scoring (stocking rate) for the offset area is low (four out of ten). This assessment, including the current quality and availability of habitat resources for the species, was determined and assessed by a recognised specialist on the Dulacca Woodland Snail (Boobook 2019). In addition, with management and implementation of habitat restoration strategies, it has been determined that the capacity of the area to support the species and a larger population could be improved.



Plate 4 Dulacca Woodland Snail shells found within the offset area

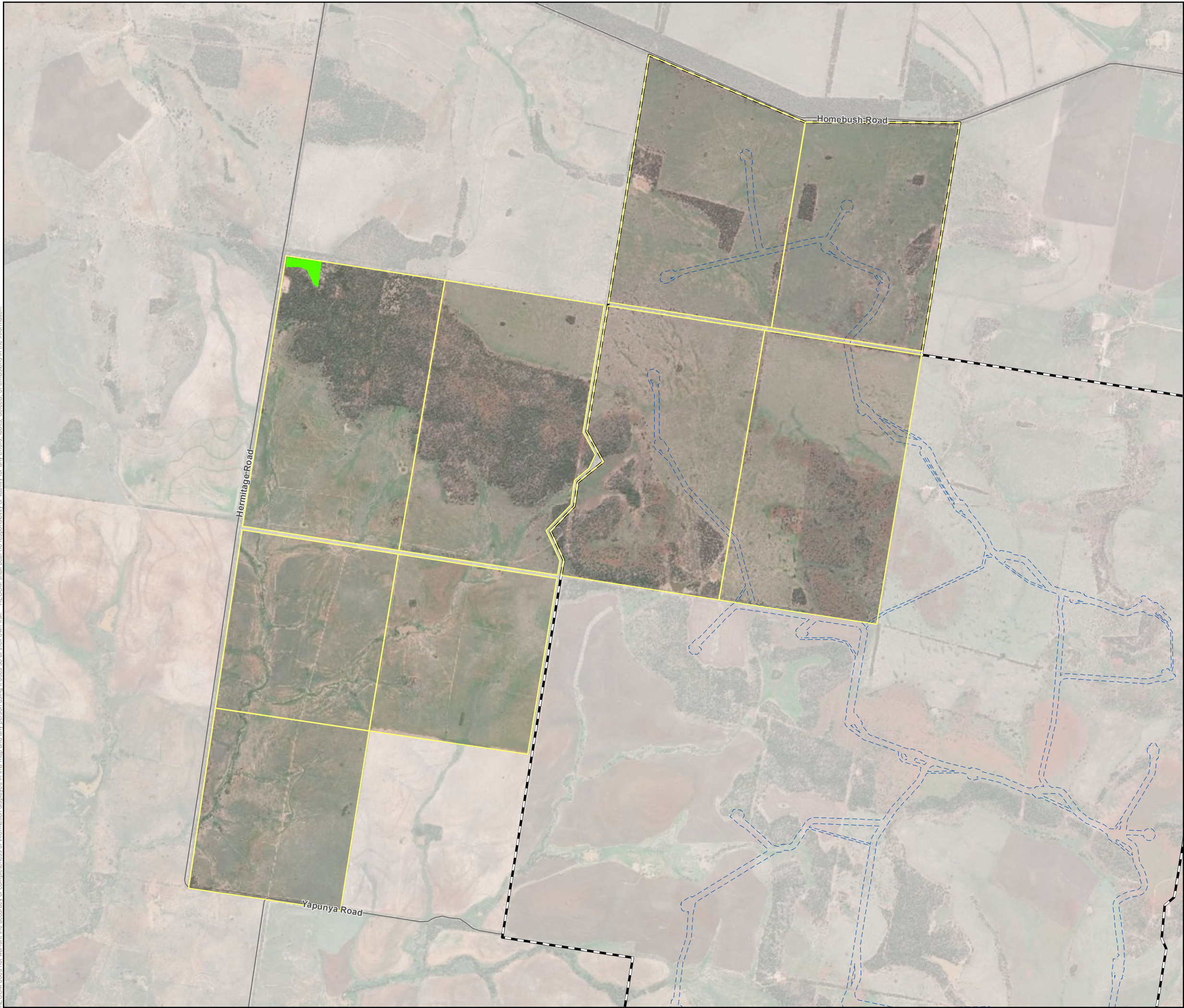
2.7 Landscape values

The offset area forms the north-western extent of the vegetated ridgeline that bisects the property. This ridgeline extends across adjacent properties and connects to a vegetated road reserve where Dulacca Woodland Snail was also confirmed (Figure 3). The road reserve is predominantly fragmented and isolated from other remaining areas of vegetation. Only a small drainage line that passes through the road reserve provides a minor and very narrow linkage via other connecting tributaries to the Yuleba State Forest, located approximately 25 km to the west of the offset area.

2.8 Threatening processes

Threatening processes identified within the offset area include historical broadscale clearing, fire, cattle grazing, pest species incursion and grazing / trampling by macropods. These threatening processes range from moderate to severe.

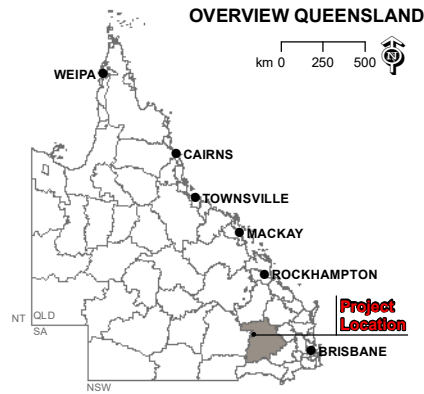
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DATUM GDA 1994, PROJECTION MGA ZONE 55
0 0.5 1
Kilometres
1 cm = 300 m (when printed @ A3)

Legend

- Study Area (8,177 ha)
- Disturbance Footprint
- Other roads
- Proposed offset area (3 ha)



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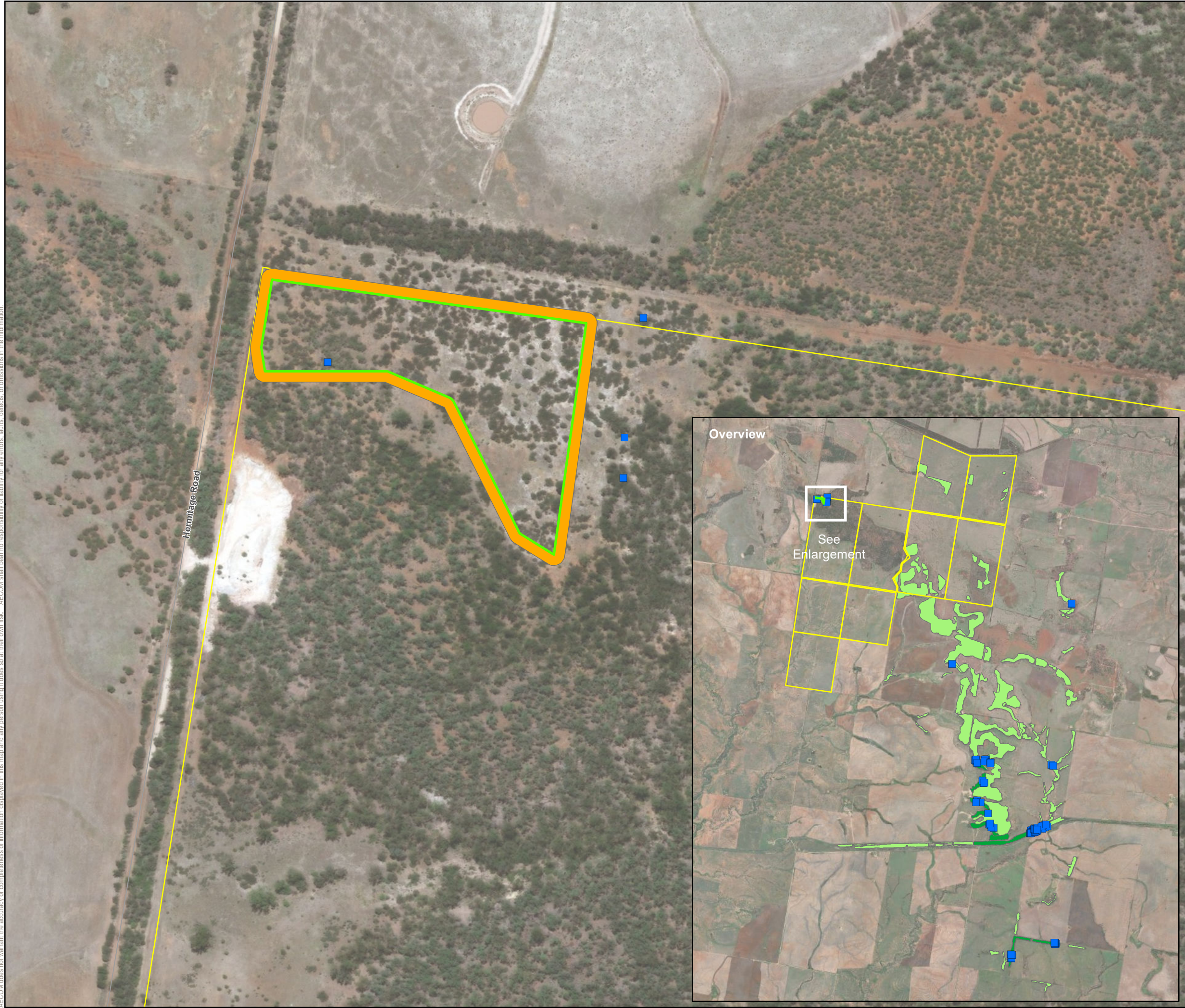
DULACCA RENEWABLE ENERGY PROJECT

HERMITAGE PROPERTY AND PROPOSED OFFSET AREA

PROJECT #: 60567855
CREATED BY: AS
LAST MODIFIED: 16/10/2020
VERSION: 2

Figure
2

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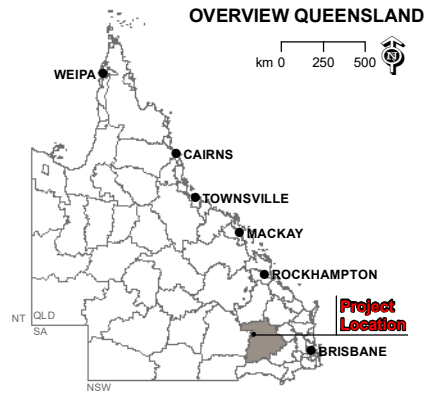
DATUM GDA 1994, PROJECTION MGA ZONE 55

0 50 100
Meters

1 cm = 33 m (when printed @ A3)

Legend

- Proposed offset area (3 ha)
- Hermitage property
- Dulacca Woodland Snail records (Boobook 2019)
- Fence lines & setback (10 m)
- Dulacca Woodland Snail Habitat**
 - Potential
 - Confirmed



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DULACCA RENEWABLE ENERGY PROJECT

PROPOSED OFFSET AREA VALUES

PROJECT #: 60567855
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LAST MODIFIED: 16/10/2020
VERSION: 2

Figure
3

3.0 Offset Suitability

The offset area has been assessed against the Commonwealth Offsets Assessment Guide (OAG) for Dulacca Woodland Snail habitat impacted by the Project. Attributes associated with the offset area and impact area start quality (site condition, site context and species stocking rate) have been determined by utilising the methodology outlined in the Queensland Guide to Determining Terrestrial Habitat Quality.

The method for the site condition and site context component of Guide to Determining Terrestrial Habitat Quality has been directly utilised to determine these aspects of the start quality calculations. For the species stocking rate aspect of the start quality calculations, the fauna habitat index methodology from the Guide to Determining Terrestrial Habitat Quality has been slightly adapted and included the assessment of the following attributes for the Dulacca Woodland Snail:

- presence and abundance
- threats to species
- quality and availability of food and foraging habitat
- quality and availability of shelter
- species mobility capacity
- role of site location to species overall population in the state.

The criteria utilised to assess and score these attributes, as well as the overall site condition and site context scoring for the offset area and impact site is provided in Appendix A.

3.1 OAG assessment

3.1.1 Impact site

Suggested attribute values for use in the Commonwealth OAG have been generated for the impact site and are provided in Table 2.

Table 2 Commonwealth OAG values for Dulacca Woodland Snail habitat at the impact site

Attribute	Score	Rationale
Area (ha)	1.49 ha	Significant residual impact as determined by the prepared Preliminary Documentation
Condition	5	Overall habitat quality calculations based on site condition, context and species stocking rate assessments, determined the condition of Dulacca Woodland Snail habitat within the impact area to be five out of ten (Appendix A).
Total quantum of impact to be offset	0.75	As per OAG

3.1.2 Offset area

Suggested attribute values for use in the Commonwealth OAG have been generated for the offset area are provided in Table 3 and further described in the following sections.

As demonstrated in the calculations in Table 3, the proposed offset area directly offsets more than 100% of anticipated significant residual impacts on Dulacca Woodland Snail resulting from the Project. The offset provides an overall net conservation gain by improving both current condition and protecting the extent of Dulacca Woodland Snail habitat. The proposed offset area will deliver a conservation outcome that will maintain and improve the viability of the affected MNES.

Existing condition

As outlined in Section 2.6 the quality and condition of the vegetation community, habitat and specific habitat features for Dulacca Woodland Snail within the offset area is moderate (five out of ten). Brigalow low open forest habitat is present but in regrowth form, with a degraded canopy and understory layer and overall low floristic diversity. Subsequently, availability of habitat resources is low and specifically for Dulacca Woodland Snail, the lack of contiguous canopy and ground layer impacts on the microclimate, movement opportunities and habitat niches for the species. However, recruitment levels are at 100% indicating that the habitat is successfully regenerating and a sufficient extent of habitat, particularly microhabitat is present to support a population of the species for breeding, foraging and dispersal purposes.

Counterfactual for risk of loss

The offset area occurs within the Dulacca Downs subregion of the southern Brigalow Belt. Data and imagery obtained from the Queensland Government's State-wide Landcover and Trees Study (SLATS) shows that between the periods of 1999 and 2018, 13,741 ha of vegetation was lost in this subregion as a result of settlement, infrastructure, mining, pasture, crop and forestry development. The average rate of clearing during this period equates to 5.26% per annum.

The offset area is not currently protected from vegetation clearing under State legislation. Ongoing clearing of regrowth vegetation within the offset area also falls under the existing use exemption (section 43A and section 43B) of the EPBC Act. The offset area is therefore subject to clearing activities and will undergo maintenance clearing within 10 years time in the absence of the establishment of the proposed offset. Risk of loss without the offset area is therefore considered comparable to the rate of loss experienced in the Dulacca Downs subregion.

With the offset area designation, the current regrowth vegetation and associated habitat values will remain. No clearing will be undertaken. Current habitat will be allowed to regenerate and improve, which in turn will provide an increase habitat resources to support a greater number of individuals. No loss of habitat will occur.

Counterfactual for future quality

Field surveys of the offset area identified active processes present that threaten the future quality of the offset area. This includes broadscale clearing, fire, cattle grazing, pest species incursion and grazing / trampling by macropods.

As previously discussed, without the offset area designation this area will undergo maintenance clearing within 10 years time. In areas where some form of habitat will remain after clearing, this habitat will be degraded. Understorey microclimate will be altered and the structural complexity of the ground layer will be reduced. Cattle and pests will continue to trample the understorey, which will reduce the extent and amount of critical microhabitat that the species relies on. Other threatening process will persist such as weed incursion, which will continue to reduce the dispersal opportunities for the species. Whilst regrowth communities are considered to be on a trajectory of improvement, in the context of the key habitat attributes for the species, these ongoing threatening processes are creating a trajectory of decline in future habitat quality for the Dulacca Woodland Snail. The modelled site condition, site context and species stocking rates for the scenario without an offset demonstrates a two-point decline in quality. This modelled scenario is provided in Appendix C.

With the offset area designation, no clearing will be undertaken and grazing activities as per the current unrestricted regime will cease. Natural regeneration will be allowed to occur and habitat improvement for the species will be supported through measures such as the translocation of fallen woody debris (where practicable). Fire, weeds and pests will be actively managed so that these threatening processes and the impact they have on the offset area are significantly reduced. This will ensure that quality and condition of the habitat specifically for the species is on an upward trajectory. The modelled site condition, site context and species stocking rates for the scenario with an offset demonstrates a two-point increase in quality. This modelled scenario is provided in Appendix C.

Table 3 Commonwealth OAG values for Dulacca Woodland Snail habitat within the proposed offset area

Attribute	Score	Rational
Area (ha)	3	Area verified in field assessments conducted by Boobook (2019)
Quality		
Start quality	5	Site condition is moderate (five out of ten) as whilst the community is regenerating structural complexity and species diversity is low and habitat resources such as hollow-bearing trees and fallen woody debris have been reduced. Site context is moderate (five out of ten) as whilst the area forms part of a larger patch, this patch is isolated and has low connectivity with surrounding areas of vegetation. Species stocking rate is moderate (four out of ten) as whilst the species was found to be present, numerous threatening processes were found to be active within the habitat, which is impacting on the availability of foraging and sheltering resources for the Dulacca Woodland Snail. Overall start quality data, scores and weightings for the offset area are provided in Appendix A.
Future quality without offset	3	The proposed offset area will undergo maintenance clearing within 10 years time. Cattle grazing will continue as per the current regime and other threatening processes such as weed and pest incursion will persist. All factors are significantly impacting the condition and quality of habitat to the point where it is on a trajectory of decline. This is impacting on the viability of the persisting population of Dulacca Woodland Snail. It is estimated that within 20 years time the quality of the area without an offset designation will decrease by at least two points (Appendix C).
Future quality with offset	7	Natural regeneration will be allowed through prohibition of clearing and additional habitat improvement strategies will reduce impacts of threatening processes and enhance the quality of availability habitat resources for the species. It is estimated that within 20 years time the quality of the offset area will increase by at least two points (Appendix C).
Time until ecological benefit	20	Estimated time for native species and vegetation structure to regenerate
Confidence in quality scores	80%	Improvement in vegetation structure is reliant on natural regeneration and therefore natural processes. However active management such as the translocation of fallen woody debris, pest and weed control and controlled grazing can effectively improve other degraded condition parameters such as weed levels, groundcover complexity, diversity and abundance. These measures are proven strategies to improve habitat quality and condition.
Raw gain	4	As per OAG

Attribute	Score	Rational
Adjusted gain	3.2	As per OAG
Risk of Loss		
Risk of loss without offset	5%	The proposed offset area will undergo maintenance clearing within 10 years time. Risk of loss is therefore considered comparable to the rate of loss that occurs across the broader Dulacca Downs subregion, which in the last 20 years has had a vegetation clearing rate of 5.26% per annum as supported by data and imagery from the QLD Government's SLATS.
Risk of loss with offset	2%	The offset area will be legally secured, clearing activities will be prohibited and grazing will be reduced. Management actions and remediation activities will be in place to assist in reducing these risks or the severity of outcomes. Consequently, the risk of failure and subsequent loss is extremely low.
Time over which loss is averted	20	Maximum 20 years
Confidence in risk scores	85%	The offset area will be legally secured with clearing activities prohibited. This will effectively reduce risk of loss.
Raw gain	0.09	As per OAG
Adjusted gain	0.06	As per OAG
Results		
Net present value	0.76	As per OAG
TOTAL % impact offset	102.10%	Proposed offset area offsets significant residual impacts on Dulacca Woodland Snail

3.2 Compliance with offset principles

The delivery of environmental offsets is to comply with the EPBC Act Environmental Offsets Policy 2012. The EPBC Act environmental offsets policy 2012 was developed with the purpose of improving environmental outcomes through the consistent application of best practice offset principles. The policy provides additional guidance on the identification and assessment of suitable offsets, helping to ensure that projects approved under the EPBC Act are consistent, transparent and achieve high quality environmental outcomes.

The policy outlines offset principles that govern the selection and nature of offsets and government assessment and decision-making. The Project's compliance with these principles is outlined below.

1. *Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action*

The offset area contains regrowth vegetation that provides suitable habitat for the Dulacca Woodland Snail. The species has also been confirmed within the offset area. The offset area provides offsets in excess of minimum requirements, which will result in a net conservation gain and overall improvement in the viability of the value being impacted.

The management strategies have been designed to ensure that conservation outcomes for the Dulacca Woodland Snail are achieved, which are based on the recovery actions developed for the

species (refer to Section 4.0). Threatening processes within the offset will be mitigated and the habitat quality will be increased to provide for sustainable populations of Dulacca Woodland Snail. In doing so the proposed offset area will deliver a conservation outcome that will maintain and improve the viability of the affected MNES.

2. Suitable offsets must be built around direct offsets but may include other compensatory measures

The proposed offset will provide a direct land based offset and measurable conservation gain mitigating more than 100% of the impacts associated with the Project. The management of the offset will also address the key priority actions outlined in the recovery plans for Dulacca Woodland Snail (refer to Section 4.2).

3. Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter

The proposed offset will provide a direct offset and measurable conservation gain of more than 100% of the impacts associated with the Project. The proposed offset has been developed using the OAG which incorporates the level of statutory protection of each protected matter being offset.

4. Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter

The proposed offsets will provide a direct offset and measurable conservation gain of more than 100% of the impacts associated with the Project. The proposed offset has been developed using the OAG, which uses the area of impact and the quality of habitat to assess the total quantum of impact to protected matters that needs to be offset. As such the offset area is of a size and scale that is proportionate to the unavoidable impacts on protected MNES values.

5. Suitable offsets must effectively account for and manage the risks of the offset not succeeding

Potential risks to the success of the offsets have been identified in this plan (refer to Section 4.3). Additional measures and remedial actions have been developed and will be implemented if any potential risks occur. In addition to this, a monitoring and reporting schedule has been developed which will assess the condition of the offset at regular intervals and trigger changes to the management strategies as required.

6. Suitable offsets must be additional to what is already required, determined by law or planning regulations, agreed to under other schemes or programs

The proposed offset area does not have any existing formal conservation arrangement in place or existing requirements from other approvals that require the landowner to undertake conservation works. Current permitted land use across the offset area includes maintenance vegetation clearing and cattle grazing (refer to Section 2.5).

7. Suitable offsets must be efficient, timely, transparent, scientifically robust and reasonable

Direct, land-based offset has been selected as the preferred offset methodology for this Project as it is a robust and widely accepted approach, with a high degree of confidence in outcome. Per condition 15 of the EPBC Act Approval, the approval holder will:

- secure a legal agreement with the landowner to protect at least 3 ha of the Hermitage Property Offset area as described in this BOP, prior to the commencement of the action, and
- legally secure the Hermitage Property Offset area within 6 months of the commencement of the action.

Further, in accordance with condition 16 of the EPBC Act Approval, the approval holder will implement this BOP at the Hermitage Property Offset area for the duration of the approval to restore Dulacca Woodland Snail habitat to the BioCondition attribute targets prescribed within this BOP.

Based on the OAG, ecological benefit will be achieved for the Dulacca Woodland Snail within 20 years. This plan has been prepared to ensure the efficient and effective delivery of a conservation outcome in a timely manner.

8. *Suitable offsets must have transparent governance arrangements, including being able to be readily measured, monitored, audited and enforced*

The offsets will be secured using a Voluntary Declaration (Vdec) under the provisions of the *Vegetation Management Act 1999* (VM Act) (or similar State mechanism). As per the requirements of the Vdec, a detailed offset area management plan will be prepared that will incorporate the details of offset management that are included in this plan (Section 4.0). A monitoring program and reporting schedule has also been developed and is included in this plan (Section 5.0).

4.0 Offset Management Plan

4.1 Offset management objectives and outcomes

The overall management objective of the proposed offset area is to reduce threatening processes and increase the habitat quality of the area for the Dulacca Woodland Snail to a level at which it provides greater conservation value than its current form and the current impact site.

More specifically, the desired conservation outcome is to protect and restore habitat in order to increase habitat extent, resources and patch connectivity so that viable populations of the species can be sustained. This is to be done by achieving the following condition values at a 10-year (as prescribed by condition 17 of the EPBC Act approval) and 20-year milestone as outlined in Table 3.

The intent of the offset management plan is to achieve the below values within the shortest timeframe allowable. Achieving the condition values for each of the milestones will be subject to prevailing climatic conditions.

Any risk of the BOP and its associated management strategies not succeeding is mitigated by the following inclusions and requirements:

- Offset management strategies supported by clear performance criteria as described in Sections 4.2.1, 4.2.2, 4.2.3 and 4.2.4.
- Clearly defined offset management risks, as described in Section 4.3, which include proposed measures to minimise risk, remedial actions (if risk occurs) and proposed follow up action/s.
- A comprehensive monitoring regime, specified in Section 5.1, including frequency, method and location.
- Effective reporting mechanisms, as outlined in Section 5.2, to report on the implementation of the plan at specific milestones. The Project Owner will amend the management measures as necessary in response to regular reviews, monitoring results and changes in legislation.
- A detailed offset implementation strategy, described in Section 6.1 and Table 12, detailing the management and monitoring requirements, timing, schedule, responsibility, corrective action and reporting requirement.
- Scheduled BOP reviews as outlined in Section 6.2. The BOP reviews will assess the effectiveness of management strategies and any required modifications to the ongoing management of the offset will be discussed with DAWE (as required) and implemented at the time.

Table 4 Offset area condition values at 10-year and 20-year milestones

Condition indices	Condition values	
	10 year	20 year
Recruitment of woody perennial species	>75% of dominant canopy species present as regeneration	>75% of dominant canopy species present as regeneration
Native plant species richness	>25% to 90% of benchmark number of species within each life-form (forbs = >1; grasses = >2; shrubs = >2; trees = >2 species)	>25% to 90% of benchmark number of species within each life-form (forbs = >1; grasses = >2; shrubs = >2; trees = >2 species)
Tree canopy height	>40% of benchmark height (>6 m)	>70% of benchmark height (>9.8 m)
Tree canopy cover	>50% or ≤200% of benchmark cover (>20% <80% canopy cover)	>50% or ≤200% of benchmark cover (>20% <80% canopy cover)

Condition indices	Condition values	
	10 year	20 year
Shrub cover	NA	>= 10 to <50% or >200% of benchmark shrub cover (>1.6% or >32% shrub cover)
Native perennial grass cover	≥25 – <50% of benchmark native perennial grass cover (>4% - <8%)	≥50 – 90% of benchmark native perennial grass cover (>8%)
Organic litter cover	NA	>50% or ≤200% of benchmark organic litter (>17.5% <70% organic litter cover)
Coarse woody debris (CWD)	NA	>50% or ≤200% of benchmark number or total length of CWD (>282.5 m <1,130 m)
Weed cover	<5% of vegetation cover are non-native plants	<5% of vegetation cover are non-native plants
Weed abundance	Abundance of non-native species is no greater than baseline levels	NA
Dulacca woodland snail population	Baseline levels increased by 50% of modelled quality scenario with offsets (Appendix C) i.e. presence of at least 10 - 17 individuals	Modelled quality scenario with offsets achieved (Appendix C)

Benchmark = quantitative value for the relevant BioCondition attribute specified for RE11.9.1 by the Queensland Herbarium, as described in the BioCondition Benchmarks for the Brigalow Belt Bioregion (10/1/2019) or a subsequent version approved by the Queensland Government

4.2 Offset management strategies

A range of offset management strategies have been developed to ensure offset management objectives and desired conservation outcomes are achieved. These strategies include stock management, natural regeneration and microhabitat enhancement, weed, pest and herbivore management and fire risk management.

The proposed management strategies have been developed in line with conservation actions outlined in relevant Conservation Advice for Dulacca Woodland Snail prepared by the Threatened Species Committee (2016)(Table 5). Specific performance criteria for each management strategy have also been developed to provide a measurable target of the offset management objectives and the overall desired conservation outcomes for the offset area.

Table 5 Offset management strategy compliance with recovery plan and threat abatement plans

Conservation action	Offset management strategies			
	Stock management	Natural regeneration / Microhabitat enhancement	Weed, pest & herbivore management	Fire management
Prevent land clearing at known localities		✓		
Investigate formal conservation arrangements, management agreements and covenants on private land	Offset area legal security			

Conservation action	Offset management strategies			
	Stock management	Natural regeneration / Microhabitat enhancement	Weed, pest & herbivore management	Fire management
Retain a buffer of native vegetation and leaf litter around all occurrences		✓		
Manage any other likely, potential or emerging threats to habitat quality i.e. weeds, removal of firewood and rocks		✓	✓	
Erect appropriate signage to indicate conservation of the species	Offset area legal security			
Ensure land managers are aware of the species' occurrence and provide protection measures against key and potential threats	Offset area legal security			
Identify and control buffel grass and any other weeds			✓	
Manage predation and possible trampling by feral pigs			✓	
Where possible, manage predation by rats and mice			✓	
If livestock or horses occur in the area, manage trampling	✓			
Prevent all high intensity fires and manage fires to not disrupt the life cycle of the species, degrade habitat or promote weeds and pest species				✓

4.2.1 Stock management

The offset area, as part of a wider paddock, is currently utilised for cattle grazing purposes. Cattle grazing can lead to detrimental impacts that cause direct species mortality through trampling as well as habitat degradation, such as a reduction in ground layer diversity, structure and recruitment, an increase in exotic perennial grass cover and soil compaction. At present, stocking rates are not fixed on the property but are rather subject to changes in grass cover and seasonal conditions. Evidence of cattle grazing threats are evident across the proposed offset area, as demonstrated by the low species diversity and the lack of understorey and groundcover vegetation.

Management strategies to mitigate the impact of grazing within the offset area include the predominant exclusion of domestic livestock, with grazing only permitted to manage fuel loads where necessary. The lower grazing intensity will allow the ground layer diversity and structure to recover and species recruitment to increase, which will aid in the natural regeneration of the habitats. Risk of trampling will also significantly reduce.

Reduced grazing intensity may result in an increase in Buffel Grass coverage and higher bushfire fuel loads within the understorey of habitats. The increased risk of fire and the potential threats associated with an altered fire regime (higher intensity and higher frequency fires) on the Dulacca Woodland Snail within the offset area, will be managed through controlled grazing during dry periods (April to October). This will control the growth of exotic perennial species and prevent large fuel loads from accumulating within the offset area before daily temperatures and bushfire risks increase during the summer months.

Management of exotic grass fuel loads through cattle grazing will only be required until the canopy of sufficiently recovers and naturally 'shades out' the growth of Buffel Grass. As such stock management across the offset area will need to adopt an adaptive approach and only be implemented where the subsequent risks of fire are high owing to the presence of high or exotic vegetative ground cover.

Cattle grazing is still considered a threatening process in the offset area and regular monitoring during periods of controlled grazing will need to be undertaken to ensure the benefits of reducing fire risk are not being outweighed by the associated impacts. This will be determined by implementing a minimum grass cover threshold that needs to be maintained across the offset area. In addition, ecological condition and population monitoring events will occur at year 1 and 5, with results reported at year 5. As part of the reporting process, the effectiveness of management measures will be reviewed, which will include the controlled grazing regimes within the offset area.

Management actions, rationale and the performance criteria (including trigger thresholds) for stock management strategy across the offset area are summarised in Table 6.

Table 6 Summary of stock management strategy

Management action	Rationale	Performance criteria
Exclusion of domestic livestock from offset area except during periods of fuel reduction	Exclusion of livestock will limit trampling impacts and degradation to habitat	No cattle present during exclusion periods. Habitat reaches the required RE benchmark percentage levels (refer to Section 4.1) for fallen woody debris, native grass cover and vegetation structure.
Controlled grazing of domestic livestock for the purpose of reducing fuel loads during the dry season (April to October)	Controlled grazing may be required to limit Buffel Grass infestation and limit the risk of bushfire	Minimum grass cover to be present at the end of the dry season (October): 60% groundcover or 850 kg / ha pasture biomass.
Installation and maintenance of stock proof fencing	Installation and maintenance of stock proof fence will allow for effective controlled grazing to take place to maximise benefit to the offset area	No breaches in fencing during exclusion times Timely repair of fencing where damage occurs.

4.2.2 Natural regeneration

The offset area consists of regrowth vegetation as a result of a continued legacy of land clearing. This has reduced the extent of habitat and habitat resources for the Dulacca Woodland Snail, which has impacted on the population of the species persisting in the area.

Management strategies to reduce the impacts of historical land clearing and habitat modification across the offset area includes the prohibition of any timber harvesting, firewood collection, cultivation and vegetation clearing, as well as the facilitation of the natural regeneration processes through stock management and weed management. This will encourage the recruitment and regeneration of canopy and mid-storey species, which in turn will provide greater structural diversity and increase the habitat value of the offset area for the threatened species.

Active assistance of this process will be also undertaken by translocating logs and fallen woody debris to the offset area where practical. This will result in the immediate increase of habitat resources that the species utilise for the following purposes:

- diurnal sheltering
- breeding and protection of laid eggs from desiccation
- aestivation during periods of inactivity.

It should be noted that under the VM Act, clearing to maintain existing fences and firebreaks (or any necessary infrastructure) is considered exempt clearing. These areas have been excised from the offset area so that no additional clearing for maintenance purposes will be required or undertaken following the legal security of the offset area. Any new fences, roads or tracks will be constructed outside of the designated offset area boundary (as shown in Figure 3).

Management actions, rationale, zones for implementation and the performance criteria for natural regeneration strategy across the offset areas are summarised in Table 7.

Table 7 Summary of natural regeneration strategy

Management action	Rationale	Performance criteria
Salvaged logs and fallen woody debris to be relocated into the offset area to further enhance habitat values where practical	The addition of microhabitat features will increase the habitat value of the offset area by providing sheltering and breeding resources for the Dulacca Woodland Snail	Habitat reaches the required RE benchmark percentage levels (refer to Section 4.1) for fallen woody debris.
Prohibition of timber harvesting, firewood collection, vegetation clearing and cultivation	Cessation of land clearing, thinning and cultivation within the offset area will allow regeneration of disturbed regrowth areas, which are on a natural trajectory of improvement	No evidence of recent forestry, timber harvesting or cultivation activities are evident during term of the offset management plan. Habitat reaches the required RE benchmark percentage levels (refer to Section 4.1) for canopy height, canopy cover, shrub cover, native grass cover and species diversity.

4.2.3 Integrated weed, pest and herbivore management

Exotic pasture grasses, weeds, pest animals and native herbivores were identified in the offset area and surrounding area during the surveys undertaken in October 2019. Pest animals pose a predation or trampling threat to the species whilst exotic pastures and weeds degrade habitat, increase fire risk and impede movement opportunities for the species. Native herbivores also impact on species habitat through modification or reduction of the ground layer structural complexity.

To reduce the impacts associated with weed, pest animals and native herbivores within the offset area, an integrated weed and pest management strategy will be implemented that firstly aims to avoid the introduction of weeds and pests and secondly controls or manages current infestations and small outbreaks as they arise. The BOP has been developed having regard to *Western Downs Regional Council Biosecurity Plan* developed by Western Downs Regional Council in accordance with *Biosecurity Act 2014* and which 'defines and outlines the fundamental strategies, objectives and outcomes necessary for the planned and coordinated approach to pest management across the region'.

The introduction, establishment and spread of weed species including invasive plants listed as 'Restricted Matter' and 'Prohibited Matter' plant species under the *Biosecurity Act 2014* and 'Priority pest plants' defined by the *Western Downs Regional Council Biosecurity Plan*, will be controlled to ensure that they comprise a minor portion of cover (i.e. <5%) within the offset areas. Vehicle weed hygiene procedures will be employed to limit the introduction of spread of new weed species within the offset areas.

The removal of existing infestations of plants listed under the *Biosecurity Act 2014* or *Western Downs Regional Council Biosecurity Plan* will be achieved using a combination of chemical, mechanical and manual/physical control methods in accordance with the recommended guidelines published by the Queensland Department of Agriculture and Fisheries (DAF). Due to the potential sensitivity of Dulacca Woodland Snail to herbicide use, mechanical and biological methods are to be the preferred measures of eradication and control. However, where this is not possible or feasible, herbicide use is to be undertaken in a controlled manner and limited to direct application. Likely invasive plants to be

encountered and preferred methods of treatment are outlined in Appendix D. The timing and frequency of weed control activities will be guided by monitoring results.

Exotic pasture grasses such as Buffel Grass occur within the offset area. Removal of exotic pasture grasses through weed control measures is not a feasible approach and will instead be managed through controlled grazing (refer to Section 4.2.1) and the facilitation of natural regeneration (refer to Section 4.2.2).

Pest animals will be controlled using species specific control programs. The following methods will be used to eliminate and manage target pest species:

- trapping and shooting program targeting Feral Pigs
- baiting program for mice and rats
- installation of barrier fencing (ringlock design) to appropriately protect the offset area.

The installation of barrier fencing will also target the management of native herbivores and reduce the high utilisation of the offset area by black-striped wallaby.

Management of pest species is to be done utilising an integrated approach to ensure that the interaction between introduced predators and introduced prey are successfully addressed i.e. the reduction of mice and rats may increase the level of feral cat predation on native animals. Consideration should also be given to the timing of management implementation with actions undertaken when pest populations have naturally been reduced through drought and dry conditions.

Ongoing monitoring will aim to detect new outbreaks, which will be managed as per current infestations. Management actions, rationale and the performance criteria for weed, pest and native herbivore management strategy across the offset area are summarised in Table 8.

Table 8 Summary of weed, pest and native herbivore management strategy

Management action	Rationale	Performance criteria
Weed and pest animal identification	Detailed field survey of weed and pest animals is required to identify the distribution and type of species present. This will allow for prioritisation of potential hot spots and high risk species.	Baseline data on weed and pest animal presence and abundance
Weed and pest animal prevention	Control of weeds and pest animals is difficult once established / introduced. Prevention of introduction or further spread will increase the success rate of weed and pest management across the offset area.	No introduction of new weed and pest animal species
Weed, pest and native herbivore control	Control of weeds, pest animals and native herbivores will reduce habitat degradation on the site and reduce predation and trampling risks	Reduced pest animal numbers Reduce utilisation of offset area by native herbivores Weed cover across offset area <5%
Offset area setback	Indirect impacts associated with edge effects will be managed through the provision of a 10 m setback between the offset area and fence line	Weed cover across offset area <5%

4.2.4 Fire risk management

Altered fire regimes (high intensity and frequent fires) can have damaging impacts on vegetation communities, cause loss of habitat and result in the direct mortality of the species and local populations.

The reduced grazing intensity as a result of the offset area management could result in increased exotic pasture grass coverage, which will add to higher bushfire fuel loads and a greater bushfire risk across the offset area. This will be managed by undertaking periods of controlled grazing to reduce grass cover within the offset area to less hazardous levels. In addition to this, existing firebreaks across the property and surrounding the offset area will be maintained to manage the spread of fire to the offset area.

Management actions, rationale and the performance criteria for fire management strategy across the offset area are summarised in Table 9.

Table 9 Summary of fire management strategy

Management action	Rationale	Performance criteria
Maintenance of fire infrastructure	In the event of a fire, well maintained fire breaks will assist in containing the spread of fire and associated impacts. Well maintained access tracks will allow for efficient access of fire fighting vehicles.	Firebreaks and access tracks are well maintained

4.3 Offset management risks

The following table (Table 10) identifies the risks associated with each management action and the additional measures and remedial actions proposed if risks occur.

Table 10 Risks associated with management actions

Management action	Associated risk	Level of risk	Proposed measure to minimise risk	Proposed remedial action if risks occurred	Proposed follow-up
Stock management	Overgrazing / grazing pressures	Low	Monitoring of controlled grazing	Alteration of controlled grazing regime or removal of livestock	Monitoring as per Section 5.1
	Fence failures	Low	Regular landholder monitoring	Maintenance of fencing Review of fencing plan and design Clearing of vegetation at risk of impacting fence integrity (where permitted).	
Natural regeneration	Failed regeneration	Low	Weed and pest control, fire and stock management Prohibition of vegetation clearing	Alteration of controlled grazing regime, additional weed and pest control	Monitoring as per Section 5.1
Weed control, pest and native	New weed and pest introduction	Low	Weed and pest hygiene protocols and monitoring	Weed and pest control	Secondary weed control and monitoring

Management action	Associated risk	Level of risk	Proposed measure to minimise risk	Proposed remedial action if risks occurred	Proposed follow-up
herbivore management				Review of land management practices	as per Section 5.1
	Spread or persistence of existing weed infestation or pest outbreak	Moderate	Weed and pest control Controlled grazing	Additional weed and pest control Review of land management practices	Secondary weed control and monitoring as per Section 5.1
	Ongoing native herbivore grazing	Moderate	Barrier fencing	Review of fencing plan and design	Monitoring as per Section 5.1
	Edge effects	Low	Setback (10 m) from fencing to offset area that will be managed as per the offset area requirements	Additional weed and pest control Review of land management practices	Secondary weed control and monitoring as per Section 5.1
	Herbicide overspray or drift	Low	Alternate approved treatments for weed control to be used as a priority. Herbicide use is to be minimal and only directly applied	Review weed management measures and / or reduce use of herbicide	Secondary population monitoring as per Section 5.1
Fire management	High fuel loads	Low	Controlled grazing Controlled low intensity burns	Alteration of fuel reduction methods and frequency	Monitoring as per Section 5.1
	Uncontrolled fire within offset area	Low	Maintenance of firebreaks Controlled grazing	Alteration of fuel reduction methods and frequency Review of firebreak design	

4.4 Offset security

In accordance with condition 15(a) of the EPBC Act Approval, the approval holder will secure a legal agreement with the landowner to protect at least 3 ha of the offset area as described in this BOP, prior to the commencement of the action.

In accordance with condition 15(b) of the EPBC Act Approval, the offset area will be legally secured within 6 months of the commencement of the action with written evidence (including shapefiles of the offset attributes of the offset area) provided to DAWE within 20 business days of legally securing the offset area. As defined in the EPBC Act Approval, legally secure means *'to secure a legal agreement under relevant Queensland legislation, in relation to a site, to provide enduring protection for the site against development incompatible with conservation'*.

The mechanism proposed to legally secure the offset is a Vdec under the provisions of the VM Act, based on the offset meeting the criteria for an area of high nature conservation value. The Vdec will be secured to the title of the land and will be recognised and subsequently protected as a Category A area on the Queensland Regulated Vegetation map.

In accordance with condition 16 of the EPBC Act Approval, the approval holder will implement this BOP at the offset area for the duration of the approval to restore Dulacca Woodland Snail habitat to the BioCondition attribute targets prescribed within this BOP. The conservation gain as stipulated in the OAG (two-point condition increase) and as outlined in Section 4.1 is anticipated to be achieved within 20 years from the commencement of the offset area (or sooner).

The declaration of the offset area will cease once the management actions have been achieved and the Project or authorised activities have ended. Upon completion of the declaration, the area will be mapped as Category B area on the Queensland Regulated Vegetation map and will be protected as per the regulations under the VM Act.

5.0 Monitoring & Reporting

5.1 Monitoring

Monitoring of the offset area will occur in accordance with Table 11 across designated locations. Monitoring activities include:

- photo point monitoring at the commencement (baseline), and then every five years for the remaining 20 years (to be undertaken by the Project Owner, its agents, contractors or assigns)
- BioCondition in accordance with the BioCondition Assessment Manual (version 2.2) at the commencement (baseline), and then every five years for the remaining 20 years (to be undertaken by the Project Owner, its agents, contractors or assigns)
- feral animal and weed monitoring conducted concurrently with BioCondition (to be undertaken by the Project Owner, its agents, contractors or assigns)
- Dulacca Woodland Snail population surveys conducted during optimal conditions in the October to March period and by an appropriately qualified and experienced ecologist as per the following methodology:
 - Diurnal searches consisting of turning and checking inside of logs and raking through leaf litter, bark piles and the top 2 cm of soil under rocks and logs
 - Minimum two person hours survey effort / site
 - Collection of 1 L at each site of surface soil and leaf litter under logs and the base of trees for post-field sifting and sorting
- Landholder / Property Manager monitoring of grazing, pest plants, pest animals fencing, access and fire breaks.

All monitoring (including landholder / property manager observations) are to be recorded in documented or electronic form suitable for external audit.

Table 11 Offset area monitoring schedule

Monitoring action	Monitoring timeframe	Attribute monitored	Frequency	Method	Locations
Ecological condition	0 – 20 years	Native plant species richness	At the commencement of Plan (year 1), and then within 3 months of every 5 year ending period for the remaining 20 years (i.e. Year 1, 5, 10, 15 and 20)	BioCondition and photo monitoring	One representative site within the offset area Two control sites within similar habitat type (either same RE or Broad Vegetation Group)
		Tree canopy cover & height			
		Shrub cover			
		Native grass cover			
		Weed cover			
		Coarse woody debris (including translocated material)			
		Organic litter			
		Recruitment			
		Evidence of pest disturbance			

Monitoring action	Monitoring timeframe	Attribute monitored	Frequency	Method	Locations
Population survey	0 – 20 years	Presence and abundance	At the commencement of Plan (year 1), and then every 5 years for the remaining 20 years (i.e. Year 1, 5, 10, 15 and 20)	Diurnal and nocturnal active searches	Across offset area and in two control sites within similar confirmed habitat
	0 – 20 years	Recovery in abundance following detection in population decline	As required	Diurnal and nocturnal active searches	Across offset area and in two control sites within similar confirmed habitat
Grazing	0 – 20 years	Grass cover	Monthly during controlled grazing periods	Project Owner / Landholder records and photos	Within offset area
		Soil impacts e.g. pugging			
		Unmanaged stock incursions	Monthly during exclusion periods		
		Fencing failures	Quarterly		
Fire	0 – 20 years	Fuel loads	Quarterly	Project Owner / Landholder records and photos	Within offset area
		Fire infrastructure			
		Incidence and extent	As required		
Weeds	0 – 20 years	Occurrence	Quarterly	Project Owner / Landholder records and photos	Within offset area
		Weed treatment success	As required		

5.2 Reporting

The Project Owner will prepare a report on the implementation of this management plan at year 1, 5, and then every five years for the remaining 15 years (ending at year 20). The report will summarise the activities implemented under the plan and discuss the effectiveness of mitigation measures (e.g. controlled grazing), based on the results of monitoring activities.

The report prepared for year 5, 10, 15 and 20 will also include opinion from a suitably qualified ecologist on the following matters regarding the offset area:

- for a milestone year (year 10 and year 20) - compliance with the condition values for the specified milestone period (Section 4.1); or
- for a non-milestone year (year 5 and year 15) - progress and likely achievement of condition values (Section 4.1) specified for the upcoming milestone period.

The reports will be published on the Project website within one month of completion, provided to DAWE within five business days of being published on the Project website and will be made available upon request.

The Project Owner will amend the management measures as necessary in response to regular reviews, monitoring results and changes in legislation.

6.0 Offset implementation schedule

6.1 Implementation strategy

This plan has been designed to allow for adaptive management of the offset areas. The proposed method, timing and frequency of each management action is outlined in Table 12 along with the scheduled offset monitoring. Monitoring and subsequent reporting is a critical component of this plan. The results of monitoring will be used to modify the management strategies and implementation schedule in order to achieve the management objectives of the offset area.

The offset area will be implemented (established and formally registered) by the Commercial Operation Date (COD) for the Project (being the end of the construction period) at the latest with the setup of the offset occurring as safely and practically as possible within the period. Executed landowner agreements will however be in place at the commencement of construction and impact to support the next steps to formally establish and register the offset area. This supports efficient and timely delivery of the offset whilst ensuring a reasonable and practical approach that has appropriate regard to commercial obligations, financial milestones and the Project program (including commencement of early enabling works).

6.2 BOP review

It is recommended that this plan be reviewed every five years (until offset completion at year 20), concurrently with landholder, ecological condition and pest animal monitoring within the offset area. The effectiveness of management strategies will be assessed and any required modifications to the ongoing management of the offset will be discussed with DAWE (as required) and implemented at this time.

In accordance with condition 19 of the EPBC Act Approval, if opinion from a suitably qualified ecologist identifies a compliance issues for a milestone year (year 10 and year 20) or anticipates a likely compliance issue for an upcoming milestone period (refer to Section 5.2), a revised version of the BOP is to be submitted to DAWE. The revised BOP is to be submitted within 6 months of the end of year 10 and include the following advice from a suitably qualified ecologist:

- a. details of the potential or actual cause(s) of the non-achievement of required ecological condition attributes / value
- b. details of the corrective action/s to undertake in order to achieve all outstanding ecological condition attributes / value
- c. an assessment of the likely effectiveness of the proposed corrective action/s
- d. proposed timeframes for reporting to DAWE the results of implementing of the corrective actions
- e. contingency measures that will be implemented if monitoring suggests that the corrective action/s are not being effective.

The revised BOP will also include timeframes for:

- achieving updated objectives and milestones for the identified corrective actions
- implementation of contingency measures
- reversion to a previously approved plan, if corrective actions are not effective.

In accordance with condition 20 of the EPBC Act Approval, if a revised version of the BOP is required and has not been approved by the Minister within 12 months of the end of Year 10, the approval holder must cease the action until a revised version of the BOP is approved by the Minister.

Table 12 Offset area implementation strategy

Management / Monitoring requirement	Action	Method	Timing / Frequency	Schedule (Management Year)										Responsibility	Corrective action / reporting requirements
				1	2-4	5	6-9	10	11-14	15	16-19	20			
Offset area monitoring	Ecological condition	BioCondition Assessment, targeted species survey and Photo monitoring	Within 3 months of every ending five year period, post wet season			R		R		R		R	Suitably qualified ecologist ¹ appointed by the Project Owner.	Monitoring report prepared every five years outlining the results and progress of the offset area towards performance criteria and desired conservation outcomes. Recommendations on management actions incorporated into the scheduled BOP review (R).	
	Landholder records	Inspections and photo records	<u>Monthly</u> - Grass cover, grazing impacts (during controlled grazing) & stock incursions (during exclusion period) <u>Quarterly</u> - Fencing, fire infrastructure, weeds and pests <u>As required</u> – extreme weather damage, fire										Pastoral manager, landholder or suitably qualified person appointed by landholder	Identified issues addressed as per corrective action outlined for each management strategy. All records incorporated into an Offset Area Report.	
Stock management	Exclusion of domestic livestock from the offset area during low fuel hazard periods	Cattle excluded from the offset area through appropriate fencing during periods when fuel hazards are low. Exclusion to be monitored monthly.	<u>Wet season</u> - exclusion of livestock at all times <u>Dry season</u> - when grass cover is <60%. Stock exclusion monitored monthly.										Pastoral manager, landholder or suitably qualified person appointed by landholder	Cattle removed from offset area if present during exclusion periods. Offset area will be inspected to identify cause of breach i.e. broken fence line. The Offset Area Report will document any cattle breaches during the reporting period and the correlating responsive action.	
	Controlled grazing of domestic livestock for the purposes of reducing fuel loads during the dry season	Cattle introduced into offset area when timing and conditions are permissible. Grass cover and impacts monitored monthly to ensure performance criteria are met. Controlled grazing will require high intensity management and cattle may need to be introduced and removed intermittently during the permissible period.	Dry season (between April & October) when grass cover exceeds 60% & no water present in stream order 1 drainage lines across the property or gilgai. Grass cover thresholds monitored monthly.										Pastoral manager, landholder or suitably qualified person appointed by landholder	Cattle removed from offset area within two weeks if grass cover falls below threshold. Cattle to be re-instated when grass cover recovers to above threshold limits. Cattle removed from offset area within 72 hours of soil impacts being observed. The Offset Area Report will document the grazing periods that occurred in the offset areas during the reporting period and the correlating responsive actions that occurred as part of grazing management.	
	Installation of stock proof and ringlock fencing.	Install sufficient fencing to appropriately manage the offset area. Where the offset boundary coincides with the property boundary, the fence may align with the property boundary. A fenced area may include non-offset areas. Clearing for fencing is not to encroach on the offset area. A 10 m setback is to be provided between the fence line and offset area.	Any required fencing of offset areas will be established within three months of the Queensland Government approving the voluntary declaration.										Pastoral manager, landholder or suitably qualified person appointed by landholder	The Offset Area Report will document where additional fencing has been installed.	
	Maintenance of stock proof fencing.	Routinely inspect fencing to ensure effectiveness.	Quarterly										Pastoral manager, landholder or suitably qualified	Upon being notified or becoming aware of an unsecure offset area, the Pastoral Manager is to undertake fence maintenance and repairs to resecure the offset area as soon as possible and within a month.	

¹ Suitably qualified ecologist means a person who has professional qualifications and at least three years of work experience designing and implementing surveys for the EPBC Act listed threatened species and/or EPBC Act listed migratory species and their habitat, and can give an authoritative independent assessment and advice on the presence and habitat requirements of the EPBC Act listed threatened species and/or EPBC Act listed migratory species using relevant protocols, standards, methods and/or literature.

Management / Monitoring requirement	Action	Method	Timing / Frequency	Schedule (Management Year)									Responsibility	Corrective action / reporting requirements
				1	2-4	5	6-9	10	11-14	15	16-19	20		
													person appointed by landholder	The Offset Area Report will document the installation, maintenance and repair of fences during the reporting period.
Natural regeneration / enhancement	Translocation of microhabitat features into the offset area	Salvaged logs and fallen woody debris to be relocated into the offset area to further enhance habitat values. Maximum levels of fallen woody debris (>0.5m in length and 10cm diameter) to be 600m / ha and to be placed to replicate the natural environment (i.e. not stockpiled within the offset area).	During construction period of the project										Suitably qualified person appointed by the Project Owner. .	Fallen woody debris to be inspected post construction to ensure placement is appropriate and maximum levels are not exceeded.
	Prohibition of timber harvesting, cultivation and general vegetation clearing impacts	Vegetation clearing within the offset area is restricted to: - that necessary for the removal of non-native weeds or declared pests - ensure public safety Where vegetation clearing is sought for any other purpose, the Landholder must contact the relevant department administering the VM Act (Qld). Native forest practice (harvesting of timber for forestry purposes) and cultivation is not allowed under this BOP. Clearing for new fencing will be on the outside of the offset area boundary or along the property boundary. Any vegetation clearing must be undertaken in accordance with: - best practice management methods; and - any applicable legislative requirements. For example, the clearing of endangered, vulnerable or near-threatened plant species or the tampering with animal breeding places under Nature Conservation Act 1992 (Qld). A 10 m setback is to be provided between the fence line and offset area.	Permissible clearing to occur as required. Other type of clearing prohibited for the duration term of the BOP. Inspections of the offset area to be undertaken on a quarterly basis.										Pastoral manager, landholder or suitably qualified person appointed by landholder	Upon being notified or becoming aware of prohibited vegetation clearing in the offset area, the Landholder is to reassess access protocols for any lessees etc. and general access within one fortnight. The Offset Area Report will document any known prohibited vegetation clearing that has occurred during the reporting period and the correlating responsive actions. Permissible vegetation clearing also to be reported.
Integrated weed, pest and herbivore management	Weed and pest animal identification	Detailed surveys to identify the presence, abundance and distribution of weed and pest animals. Small infestations to be GPS marked and large infestations mapped out across the offset area. Priority areas and species to control are to be identified.	At commencement of offset										Suitably qualified person appointed by the Project Owner.	Presence, abundance and distribution reported with supporting maps.
	Installation of pest barrier fencing	Install sufficient fencing to appropriately manage the offset area. Where the offset boundary coincides with the property boundary, the fence may align with the property boundary.	At commencement of offset										Pastoral manager, landholder or suitably qualified	The Offset Area Report will document where additional fencing has been installed.

Management / Monitoring requirement	Action	Method	Timing / Frequency	Schedule (Management Year)									Responsibility	Corrective action / reporting requirements
				1	2-4	5	6-9	10	11-14	15	16-19	20		
		A fenced area may include non-offset areas. Clearing for fencing is not to encroach on the offset area. Fencing is to consist of ringlock design to provide a barrier to pig and black-striped wallabies. A 10 m setback is to be provided between the fence line and offset area.											person appointed by landholder	
	Weed and pest animal prevention	Removal of existing infestations of non-native weeds including invasive plants listed under the <i>Biosecurity Act 2014</i> and local council weed and pest management plans, as per the recommended controls outlined in the Department of Agriculture and Fisheries fact sheets. Use of herbicides to be minimal and limited to direct spraying methods (Appendix D). Control of existing pest animal populations listed under the <i>Biosecurity Act 2014</i> and local council weed and pest management plans to be minimised through the development of property based feral animal management, including: - Trapping and shooting program targeting Feral Pigs - Baiting program for mice and rats	Weed control will be undertaken as early as practicable within the natural regeneration process throughout the offset area and then periodically at the optimum time in their life cycles to control and minimise the spread of the existing weed species. Pest animal eradication to be undertaken as early as practicable and during dry conditions when populations are naturally reduced Weed and pest incursion to monitored on a quarterly basis										Pastoral manager, landholder or suitably qualified person appointed by landholder	Upon being notified or becoming aware of non-native weeds being present in greater than 5% of the offset area, or pest animals being present, the Pastoral Manager is to implement pest and weed control measures within one month. The Offset Area Report will document the weed and pest animal presence as well as implemented control measures
		Removal of new outbreaks as per control measures above	Upon detection of pest animals within the offset area and non-native plants being present in >5% of the offset area. Frequency of control determined through ongoing monitoring. Weed and pest incursion to monitored on a quarterly basis										Pastoral manager, landholder or suitably qualified person appointed by landholder	Upon being notified or becoming aware of non-native weeds being present in greater than 5% of the offset area, or pest animals being present, the Pastoral Manager is to implement pest and weed control measures within one month. The Offset Area Report will document the weed and pest animal presence as well as implemented control measures
Fire management	Controlled burns prohibited	Fire is to be excluded from the offset area.	Fire is prohibited for the duration term of the BOP.										Pastoral manager, landholder or suitably qualified person appointed by landholder	Upon being notified or becoming aware of prohibited fire in the offset area, the Landholder is to reassess access protocols for any lessees etc., signage and general access within one fortnight. After any occurrence of fire in the offset area, the Pastoral Manager, Landholder or suitable qualified person appointed by the Landholder will: inspect and repair, and widen if necessary, all firebreaks; and

Management / Monitoring requirement	Action	Method	Timing / Frequency	Schedule (Management Year)									Responsibility	Corrective action / reporting requirements
				1	2-4	5	6-9	10	11-14	15	16-19	20		
														- reassess fuel load reduction practices; and - exclude grazing until the grass cover present at the end of the dry season is a minimum of 60% groundcover or 850kg/ha pasture biomass. The Offset Area Report will document any known incidences of fire that have occurred during the reporting period and the correlating responsive actions.
	Maintenance of fire infrastructure	Firebreaks surrounding the offset area are to be maintained. New firebreaks are to be co-located with roads and fence lines where possible and outside of the offset area. Access tracks are to be maintained to allow fire fighting vehicles to effectively access the offset area.	Maintenance undertaken as required but on a minimum basis of every 2 years Inspections of the offset area to be undertaken on a quarterly basis.										Pastoral manager, landholder or suitably qualified person appointed by landholder	Presence of regrowth or other obstructive material is removed from firebreaks and access tracks within two weeks. The Offset Area Report will document any maintenance activities that have occurred during the reporting period
Extreme weather events	Inspection & repair of key infrastructure	Determine the extent of damage to offset area infrastructure (such as fence lines) caused by the event	As soon as safely possible										Pastoral manager, landholder or suitably qualified person appointed by landholder	Upon being notified or becoming aware of flood and cyclone event occurring in offset area, the Pastoral Manager is to undertake fence maintenance and repairs to resecure the offset area within one fortnight. The Offset Area Report will document the repair of fences because of extreme weather conditions, during the reporting period.
	Exclusion of livestock	Livestock will be removed in the event of extreme wet weather, flooding or drought if controlled grazing period is occurring.	As soon as safely possible. During drought conditions, grass conditions to be inspected monthly										Pastoral manager, landholder or suitably qualified person appointed by landholder	Upon being notified or becoming aware of a flooding or drought event occurring in offset area, the Pastoral Manager is to remove cattle from the offset area within one fortnight. The Offset Area Report will document the removal of cattle from offset areas, because of extreme weather conditions, during the reporting period.

7.0 References

- AECOM. (2018). Dulacca Wind Farm Terrestrial Fauna Survey. Brisbane, QLD: Unpublished report for RES Australia Pty Ltd.
- Threatened Species Scientific Committee. (2016). Conservation Advice, *Adclarkia dulacca* (Dulacca woodland snail). Retrieved from <http://www.environment.gov.au/biodiversity/threatened/species/pubs/83885-conservation-advice-07122016.pdf>

Appendix A

Condition data and
scores

Appendix A Condition data and scores

Impact Site												
Assessment unit	1							2			3	
Site	Benchmark	DU07		DU08		DU09		Benchmark	DU18		DU03	
RE	11.9.5							11.7.1			11.7.1	
Condition	Remnant							Remnant			Regrowth	
Field based attributes (site condition)												
	Benchmark values	Raw	Score	Raw	Score	Raw	Score	Benchmark values	Raw	Score	Raw	Score
Recruitment of woody perennial species	100	100	5	100	5	100	5	100	0	0	100	5
Native plant species richness												
Trees	2	8	5	7	5	8	5	4	0	0	2	2.5
Shrubs	10	5	2.5	7	2.5	7	2.5	8	11	5	4	2.5
Grasses	4	4	5	2	2.5	3	2.5	8	2	2.5	3	2.5
Forbs	9	9	5	6	2.5	8	2.5	9	9	5	7	2.5
Tree Canopy Height	25	11	3	12	3	12	3	20	17	5	6	3
Tree Canopy Cover	59	35.7	5	41.8	5	44	5	27	19.8	5	35	5
Shrub canopy cover	11	10.8	5	1.4	3	3	3	10	6.6	5	10	5
Native perennial grass cover	4	3.4	3	4.6	5	4	5	20	18.6	5	1	0
Organic litter cover	66	55.4	5	68.2	5	50	5	20	48.8	3	40	5
Large trees	98	20	5	34	5	26	5	20	30	15	0	0
Coarse woody debris	16	2470.25	2	1174.15	2	1650	2	424	207.8	2	150	2
Weed cover		1	10	3	10	4	10		0.1	10	1	10
Total Field based attributes			60.5		55.5		55.5			62.5		45
GIS based attributes (site context)												
Fragmented - Patch size			2		2		2			5		2
Fragmented - Connectivity			0		0		0			2		0
Fragmented - Context			2		2		2			4		0
Ecological Corridors			0		0		0			0		0
Total GIS attributes			4		4		4			11		2
Total BioCondition Score			64.5		59.5		59.5			73.5		47
Average Total BioCondition Score		61.1666							73.5			47
Species Index Scoring – Dulacca Woodland Snail (species stocking rate)												
Presence / abundance			15		10		5			5		5
Threat to species			1		1		1			7		1
Quality and availability of food and foraging habitat			10		10		5			5		5
Quality and availability of shelter			10		10		5			5		5
Species mobility capacity			1		1		1			4		1

Impact Site												
Assessment unit	1							2			3	
Role of site location to overall population in state			5		5		4			4		4
Total Species Habitat Score			42		37		21			25		21
Average species habitat score			33.33						25			21
Habitat Quality Score (measured)			94.5						98.5			68
Habitat Quality Score (max)			171						171			171
Average Assessment Unit Habitat Quality Score (out of 10)			5.53						5.76			3.98
Assessment Unit Area (ha)			0.95						0.29			0.24
Total remnant area for site (ha)			1.24								0.24	
Assessment unit size weighting remnant			0.77						0.234			1.0
Weighted Assessment unit habitat quality score remnant			4.23						1.35			
Habitat quality score for remnant	6											
Weighted Assessment unit habitat quality score regrowth												3.977
Habitat quality score for regrowth											4	
Total site Area (ha)	1.49											
Assessment unit size weighting			0.642						0.196			0.162
Weighted Assessment unit habitat quality score			3.55						1.13			0.64
Habitat quality score for all assessment units combined	5											

Offset Site			
Assessment unit	4		
Site	Benchmark	DU19	
RE	11.9.1		
Condition	Regrowth		
Field based attributes (site condition)			
	Benchmark values	Raw	Score
Recruitment of woody perennial species	100	100	5
Native plant species richness			
Trees	4	2	2.5
Shrubs	9	3	2.5
Grasses	10	1	0
Forbs	7	3	2.5
Tree Canopy Height	14	3	0
Tree Canopy Cover	40	39.2	5
Shrub canopy cover	16	2.1	3
Native perennial grass cover	16	0.4	0
Organic litter cover	35	50	5
Large trees	13	0	0
Coarse woody debris	565	300.8	5
Weed cover		0.1	10
Total Field based attributes			40.5
GIS based attributes (site context)			
Fragmented - Patch size			7
Fragmented - Connectivity			5
Fragmented - Context			4
Ecological Corridors			0
Total GIS attributes			16
Total BioCondition Score			56.5
Average Total BioCondition Score		56.5	
Species Index Scoring – Dulacca Woodland Snail (species stocking rate)			
Presence / abundance			10
Threat to species			1
Quality and availability of food and foraging habitat			5
Quality and availability of shelter			5
Species mobility capacity			1
Role of site location to overall population in state			4
Total Species Habitat Score			26

Offset Site		
Assessment unit	4	
Average species habitat score		26
Habitat Quality Score (measured)		82.5
Habitat Quality Score (max)		171
Average Assessment Unit Habitat Quality Score (out of 10)		4.82
Habitat quality score for all assessment units combined	5	

Species index scoring system		
Attribute	Criteria	Score
Presence / abundance	Present & highly abundant (>20)	15
	Present & moderately abundant (5-19)	10
	Present & low abundance (1-4)	5
	Absent	0
Threats to species	Intact habitat, grazing absent, no invasive weeds or pest species	15
	Intact habitat, light grazing, low weed and pest invasion	10
	Fragmented habitat, light grazing, scattered/moderate weed and pest species invasion	7
	Highly fragmented habitat, heavy grazing, invasive weed and pest species abundant	1
Quality and availability of food and foraging habitat	Abundance of fungi, lichen, algae, detritus/biofilm	10
	Occasional fungi, lichen, algae, detritus/biofilm	5
	Lack of fungi, lichen, algae, detritus/biofilm	1
Quality and availability of shelter	Abundant ground debris and overstorey of trees and shrubs	10
	Occasional ground debris and limited overstorey of trees and shrubs	5
	Ground debris and overstorey of trees and shrubs absent	1
Species mobility capacity	Connected habitat with suitable ground debris and canopy cover	10
	Functional habitat patches disconnected by 5m - 10m (i.e. no suitable microhabitat features for 5m-10m)	7
	Functional habitat patches disconnected by 10m-50m	4

Species index scoring system		
Attribute	Criteria	Score
	Functional habitat patches disconnected by >50m	1
Role of the site to species overall population in state	High value breeding and foraging habitat	5
	Moderate value breeding and foraging habitat	4
	Unsuitable for maintaining a population of the species	1
Max score		65

Start quality weighting system		
Scoring component	Weighting	Justification
Site condition	47%	The condition of the site (particularly micro-climate conditions) ultimately influences whether an area is suitable to support the species and is therefore the most important component and is weighted the most in the start quality scoring system
Site context	15%	Species is sedentary in nature, moving a maximum of 2m throughout its lifetime. As such site context criteria such as ecologic corridors, connectivity and patch size at a landscape scale is not as important to the species as site condition and species stocking rate. Factors such as site context still remain relevant to the species as it can influence edge effects and other indirect threats to the species.
Species stocking rate	38%	If the condition of the site is suitable to support the species, then the second most important component is species stocking rate. Maintaining a viable population through an abundance of habitat resources and high population numbers is important to sustaining the presence of the species.

Appendix B

Fauna Survey Report



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Fauna Survey Report

Targeted survey for Dulacca Woodland Snail *Adclarkia dulacca* within the Dulacca Renewable Energy Project area, Queensland.

Compiled by BOOBOOK for AECOM on behalf of RES Australia Pty Ltd

Revision	Date	Description	Author	Verifier	Approved
A	20/10/2019	Draft issued to client for review	C. Eddie, R. Aisthorpe, L. Hardwick	C. Eddie	C. Eddie
B	24/10/2019	Draft incorporating client comments issued for review	C. Eddie, R. Aisthorpe	C. Eddie	C. Eddie
C	8/11/2019	Draft incorporating client comments issued for review	C. Eddie, L. Hardwick	C. Eddie	C. Eddie
0	12/11/2019	Final report issued for use	C. Eddie		C. Eddie

Table of Contents

1.	Introduction	7
1.1	Purpose & Scope	7
1.2	Study Area Description	7
1.3	Survey Team and Timing	8
1.4	Limitations	8
2.	Species Profile	8
2.1	Taxonomy	8
2.2	Legislative Status	8
2.3	Description	8
2.4	Distribution.....	8
2.5	Ecology	9
2.6	Habitat.....	9
2.6.1	Vegetation Associations	9
2.6.2	Microhabitat	9
2.7	Movement Patterns	9
2.8	Breeding Biology.....	10
2.9	Feeding Ecology.....	10
3.	Methodology.....	10
3.1	Desktop & Literature Review	10
3.2	Field Survey	10
3.2.1	Land Snail Searches.....	10
3.2.1.1	Selection of field survey sites.....	10
3.2.1.2	Survey method.....	10
3.2.1.3	Identifying the target species	11
3.2.2	Habitat Assessments.....	11
3.2.2.1	BioCondition Assessment	11
3.2.2.2	Other Habitat Assessments	12
3.2.3	Habitat Mapping	12
4.	Results	12
4.1.1	Desktop Searches	12
4.1.2	Targeted Searches	13
4.1.3	Habitat Mapping	15
4.1.3.1	Existing Habitat Mapping.....	15
4.1.3.2	Refined Habitat Mapping.....	15
4.1.4	Habitat Quality.....	16
5.	Impact Assessment	16
5.1.1	Threats to the Species	16
5.1.2	Potential Impacts During Project Phases.....	17
5.1.3	Description of Clearing Impact Areas	20
5.1.4	Residual Risk Characterisation.....	23
6.	Mitigation and Management Measures.....	24
7.	Offset Area Assessment	27
8.	References.....	28
Appendix A.	Location of the Study Area.	31
Appendix B.	Capability Profile for Lead Project Personnel.	33
Appendix C.	Desktop search results for Dulacca Woodland Snail.	35
Appendix D.	Location of Dulacca Woodland Snail survey sites within the Study Area.	37
Appendix E.	Characteristics of Dulacca Woodland Survey sites.	39
Appendix F.	Location of Dulacca Woodland Snails detected during the survey.	43
Appendix G.	Refined habitat mapping for Dulacca Woodland Snail	45

Appendix H. Location of Potential Clearing Areas within the Project Layout. 49

Appendix I. Location of Potential Offset Areas..... 51

Abbreviations

CSG	coal seam gas
DEE	Department of the Environment and Energy (commonwealth)
DES	Department of Environment and Science (state)
DNRME	Department of Natural Resources, Mines and Energy (state)
EH	Essential Habitat
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GIS	Geographic Information System
GPS	Global Positioning System
HVR	High Value Regrowth
km	kilometre (s)
L	Litre (s)
m	metre (s)
MNES	Matters of National Environmental Significance (EPBC Act)
NC Act	<i>Nature Conservation Act 1992</i>
Qld	Queensland
QM	Queensland Museum
RE	Regional Ecosystem (s)
REDD	Regional Ecosystem Description Database
SEVT	Semi-evergreen vine thicket
TEC	Threatened Ecological Community(ies)
TSSC	Threatened Species Scientific Committee

Glossary of Terms

Study Area	Subject site.
Project Layout	Locations of infrastructure on site.
Disturbance Footprint	Maximum extent of anticipated disturbance on site.

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

Executive Summary

BOOBOOK Ecological Consulting (BOOBOOK) was commissioned by AECOM (the Client) on behalf of RES Australia Pty Ltd (the Proponent) to undertake a survey for Dulacca Woodland Snail (*Adclarkia dulacca*) as part of the Dulacca Renewable Energy Project (the Project), located approximately 7 km east of Dulacca, southern inland Queensland.

The Dulacca Woodland Snail is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act) and is so classed as a Matter of National Environmental Significance (MNES). It is also listed as endangered under the state *Nature Conservation Act 1992*. The snail was predicted to occur within the Study Area (Appendix A) during previous ecological assessments and in desktop searches. The Study Area contains the type locality for Dulacca Woodland Snail based on previous Queensland Museum collections. However, no targeted surveys for Dulacca Woodland Snail have previously been undertaken within the Study Area by suitably qualified personnel.

The objectives of this survey were as follows:

- ✦ Undertake targeted surveys for Dulacca Woodland Snail *Adclarkia dulacca* within the immediately impacted areas and potential offset areas within the Study Area.
- ✦ Review and refine mapping of habitat for the species within the Study Area.
- ✦ Undertake a habitat assessment within the Study Area.
- ✦ Undertake an assessment of the impacts on the species and its habitat within the Study Area.

A field survey was conducted over a four-day period from 8-11 October 2019. The survey targeted potential impact areas, potential offset areas, a range of sites previously mapped as Dulacca Woodland Snail habitat and a representative sample of unmapped vegetation which was considered to be potential habitat for the snail.

Key findings of the survey are summarised as follows:

- ✦ Land snails were surveyed at 19 sites within the Study Area.
- ✦ Sixteen (16) species of land snail were recorded within the Study Area;
- ✦ Dulacca Woodland Snail was detected at 15 of 19 survey sites.
- ✦ The survey detected 3 live individuals and 155 dead shells of Dulacca Woodland Snail.
- ✦ Dulacca Woodland Snail was detected in the following remnant and/or regrowth habitat types in the Study Area:
 - RE 11.7.1: *Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *Eucalyptus microcarpa* woodland on lower scarp slopes on Cainozoic lateritic duricrust.
 - RE 11.7.6: *Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust.
 - RE 11.9.5: *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks.
 - RE 11.7.1x1: Semi-evergreen vine thicket on Cainozoic lateritic duricrust.
 - RE 11.9.1: Open forest to woodland of *Eucalyptus thozetiana* and *Acacia harpophylla* on fine-grained sedimentary rocks.
- ✦ Refined mapping indicated that approximately 765.2 ha of potential habitat for Dulacca Woodland Snail occurs in the Study Area compared to 670.1 ha as previously mapped
- ✦ BioCondition sites were completed at a range of potential impact site (five sites) and within each potential offset area option (four sites)
- ✦ Potential impacts of the Project on Dulacca Woodland Snail include:
 - Loss of live individuals within clearing impact areas.
 - Loss of habitat (1.49 ha)
 - 0.78 ha of remnant Brigalow (*Acacia harpophylla*) woodland (RE 11.9.5) in two areas along the Warrego Highway.
 - 0.3 ha of remnant Mountain Yapunyah (*Eucalyptus thozetiana*) woodland (RE 11.7.1) beside turbine T16
 - 0.17 ha of remnant Brigalow woodland (RE 11.9.5) beside an access track between turbines T30 and T31
 - 0.24 ha of regrowth Brigalow woodland (RE 11.7.1) beside turbine T18.
 - Loss of microhabitat (e.g. logs) within clearing impact areas.

- Desiccation of understorey vegetation as a result of edge effects within clearing impact areas.
- Increase in spread and abundance of invasive species such as Buffel Grass (*Cenchrus ciliaris*).
- Increased fire risk particularly due to Buffel Grass invasion.

✱ A Significant Residual Impact Assessment was undertaken for Dulacca Woodland Snail which indicated that the Project is likely to have a significant residual impact on Dulacca Woodland Snail on the following basis:

- The Project could lead to a long-term decrease in the size of a significant local population (Warrego Highway).
- The Project will further fragment a significant local population (Warrego Highway) which may also result in an increase in invasive species that may become established in the species' habitat.
- The Project may interfere with the recovery of the species.
- The Project will cause disruption to an ecologically significant location (Warrego Highway) of the species.

✱ The primary mitigation measures proposed to reduce impacts include:

- Avoidance and minimising potential clearing (proposed clearing has been reduced to 1.49 ha).
- Creation of an ecological offset.

✱ Four potential offset areas were assessed, three of which contained populations of Dulacca Woodland Snail.

1. Introduction

1.1 Purpose & Scope

BOOBOOK Ecological Consulting (BOOBOOK) was commissioned by AECOM (the Client) on behalf of RES Australia Pty Ltd (the Proponent) to undertake a targeted survey for Dulacca Woodland Snail (*Adclarkia dulacca*) for the proposed Dulacca Renewable Energy Project (the Project) located approximately 7 km east of Dulacca, southern inland Queensland (hereafter referred to as the Study Area). The Project includes wind turbines, access tracks, underground cables, an energy storage facility and other associated infrastructure

The Dulacca Woodland Snail is listed as Endangered under the commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act) and the state (Qld) *Nature Conservation Act 1992* (NC Act). The occurrence of Dulacca Woodland Snail within the Study Area was predicted by previous ecological assessments (AECOM 2019a) and the Department of Environment and Energy (DEE) Protected Matters Search Tool (PMST) (DEE 2019a). A subsequent fauna impact assessment mapped potentially suitable habitat for Dulacca Woodland Snail within the Study Area (AECOM 2019a). No targeted surveys for the species have previously been undertaken by suitably qualified personnel within the Study Area. DEE has requested further information on presence, suitable habitat and potential impact of the Project on Dulacca Woodland Snail.

The objectives of this survey were based on the following requirements identified by DEE in the Request for Information (RFI) for the Project:

- ✦ Undertake targeted surveys for Dulacca Woodland Snail *Adclarkia dulacca* within the immediately impacted areas and potential offset areas.
- ✦ Review and refine mapping of habitat for the species within the Study Area.
- ✦ Undertake a habitat assessment using the findings of the surveys within the Study Area.
- ✦ Undertake an assessment of the impacts on the species and its habitat within the Study Area.

1.2 Study Area Description

The Study Area is located approximately 7 km east of Dulacca, southern inland Queensland (Appendix A, C). For the purpose of this report, the Study Area refers to the subject lots and road reserves on which the Project Layout (i.e. configuration of infrastructure) occurs. This definition of the Study Area is in accordance with AECOM (2019a) with one minor modification, this being the addition of a potential offset area option on Lot 57 on Plan BWR199. The 'Disturbance Area' refers to the bounds within which wind turbines, access tracks, underground cables, an energy storage facility and other associated infrastructure may be located.

The Study Area is located entirely within the Western Downs Regional Council and is accessed via the Warrego Highway (which bisects the Study Area), Waituna Road, Wallan Creek Road and Yapunya Road. The main land uses are livestock grazing and cropping.

The Study Area lies within Subregion 28 (Dulacca Downs) of the Brigalow Belt South bioregion (Sattler and Williams 1999). The majority of the Study Area has been cleared of native vegetation and is used for grazing and cropping. On the gently undulating clay plains that were formerly dominated by Brigalow *Acacia harpophylla* communities the few vegetated areas that remain consist of shade lines, strips and clumps of remnant or regrowth vegetation. The main area of relatively intact vegetation in the Study Area is confined to a ridge aligned north-south through the central part of the Study Area on the northern side of the Warrego Highway.

Elevation within the Study Area ranges from about 350 m to 410 m. The Roma 1: 250,000 series SG 55-12 map broadly shows the geological units present within the study Area consist of Lower Cretaceous sediments including the Coreena and Doncaster Members of the Wallumbilla Formation (Milligan *et al.* 1967).

The Study Area is drained by J D Creek in the east, Wygi Creek in the northeast and a series of un-named creeks that drain into Dulacca Creek in the west.

1.3 Survey Team and Timing

The field survey was led by Craig Eddie (BOOBOOK, Principal Ecologist) with assistance from Rosamund Aisthorpe (BOOBOOK, Botanist) over a four-day period from 8th to 11th October 2019. Craig Eddie is an ecologist and land snail specialist with over 30 years of land snail survey experience. A capability statement further outlining the qualifications of lead survey personnel is shown within Appendix B.

1.4 Limitations

The field survey and subsequent impact assessment was conducted within the Project Layout as provided by the Client. No attempt has been made to undertake a complete survey for Dulacca Woodland Snail within the entire Study Area as areas outside the Project Layout will not be disturbed by the construction and operation of the Project.

2. Species Profile

2.1 Taxonomy

The Dulacca Woodland Snail (*Adclarkia dulacca*) belongs to the family Camaenidae. It is one of three species within the genus *Adclarkia*. Although first discovered in the early 1990's, *A. dulacca* was formally described in 2010 (Stanisic *et al.* 2010).

2.2 Legislative Status

The Dulacca Woodland Snail is listed as Endangered under both the commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act) and Queensland *Nature Conservation Act 1992* (NC Act).

2.3 Description

The shell of Dulacca Woodland Snail is pale brown. Adults are approximately 17mm in diameter and have a low spire giving a flattened appearance (Stanisic *et al.* 2010). The brown spiral band on the shell described by Stanisic *et al.* (2010) is a variable feature and may be lacking in some specimens (C. Eddie pers. obs.). Like all species of *Adclarkia*, the microsculpture on the upper half of the shell is of weak growth lines with fine scales which are part of the periostracum or 'skin' on the shell (Stanisic *et al.* 2010). Protoconch (i.e. the first whorl) sculpture is of tiny, scattered pustules (Stanisic *et al.* 2010). The lower half of the shell is smooth and glossy with a narrow umbilicus (i.e. opening on the underside). The lip is thin (Stanisic *et al.* 2010) but is noticeably thicker than Brigalow Woodland Snail (*A. cameroni*) and Boggomoss Snail (*A. dawsonensis*) (C. Eddie pers. obs.). The shell is much flatter than the Brigalow Woodland Snail which also occurs within the range of the Dulacca Woodland Snail. The Boggomoss Snail does not occur within the range of the Dulacca Woodland Snail (Stanisic 1996).

The living animal of Dulacca Woodland Snail is described as being "orange-brown" (Stanisic *et al.* 2010). The mantle is pale orange (C. Eddie pers. obs.).

2.4 Distribution

Publicly accessible records of Dulacca Woodland Snail (ALA 2019, QM 2019) show that it is found in a small area of southern inland Queensland between Yuleba and Miles in the west and east respectively, and between Wandoan and Meandarra in the north and south respectively (Appendix C). Most records are centred on the Dulacca area (ALA 2019).

The entire distribution of the species is within the Brigalow Belt South Bioregion. The majority of records lie within Subregion 28 (Dulacca Downs) with outliers in Subregion 26 (Southern Downs) and Subregion 31 (Eastern Darling Downs). All of these subregions have extensive areas of fertile clay plains (Sattler and Williams 1999) that are substantially cleared of native vegetation. Most notably, Subregion 28 (Dulacca Downs) which contains the bulk of the known distribution of Dulacca Woodland Snail in Queensland, has less than 15% remnant vegetation cover (DES 2019a). Consequently, the current distribution of Dulacca Woodland Snail is highly fragmented (ALA 2019) being largely restricted to patches or strips of habitat retained on roadsides, shade lines and/or ridges.

2.5 Ecology

There are no studies of the ecology of Dulacca Woodland Snail. The species is known to live in a variety of forest and woodland types where it shelters under logs, rocks, and other ground debris (Stanisic *et al.* 2010, TSSC 2016). Like other camaenid land snails the species is presumed to be active at night after rain. During periods of inactivity the Dulacca Woodland Snail will aestivate (i.e. enter a period of dormancy) at its chosen shelter site. In order to conserve moisture, live snails attach to the underside of a log, rock, leaves or the ground surface and seal any gaps in the shell opening with mucus. Burrowing into shallow soil has been observed in captivity (C. Eddie pers. obs.)

2.6 Habitat

2.6.1 Vegetation Associations

At the time of the species description Stanisic *et al.* (2010) described the habitat of the Dulacca Woodland Snail as “vine thicket/woodland on rocky outcrop”. This description refers primarily to the habitat at the type locality (Appendix C) which is within the Study Area. At this location snails were found under rocks in “degraded thicket/*Brachychiton*” (Stanisic *et al.* 2010). Other than vine thicket, the species is known to occur in Brigalow (*Acacia harpophylla*) woodland/open forest, ironbark (*Eucalyptus* spp.) woodland, Lancewood (*Acacia shirleyi*) woodland and Gum-topped Box (*E. woollsiana*) woodland (TSSC 2016).

Although habitat preferences are not completely known most records of the species are from regrowth or remnant Brigalow (*Acacia harpophylla*) communities (Queensland Museum 2019, C. Eddie unpublished data) or other vegetation types that adjoin Brigalow communities. Brigalow woodland and open forest can therefore be considered an important habitat for the species. All Brigalow communities within the known range of the Dulacca Woodland Snail are endangered regional ecosystems (REs) under the *Vegetation Management Act 1999* and/or have a biodiversity status of endangered as per the Regional Ecosystems Description Database (REDD) (DES 2019b). Most Brigalow REs within the range of the Dulacca Woodland Snail are also Threatened Ecological Communities (TECs) (DEE 2019b). Hence, most of the habitat of high importance to the species is under threat.

2.6.2 Microhabitat

The Dulacca Woodland Snail shelters beneath logs, under rocks, among leaf litter and in loose bark at the base of trees (Stanisic *et al.* 2010, C. Eddie pers. obs.). The species can occur in non-remnant habitats (e.g. regrowth) providing there are suitable shelter sites (Eddie in TSSC 2016).

In summary, microhabitat features critical to the survival of the species include:

- ✱ Logs;
- ✱ Rocks;
- ✱ Timber/vegetation piles;
- ✱ Loose bark piles;
- ✱ Loose bark at the base of trees; and
- ✱ Dense leaf litter.

2.7 Movement Patterns

Nothing is known of the movements of Dulacca Woodland Snail; however the species is considered to be of low mobility (Stanisic in TSSC 2016). Movement between suitable microhabitat sites (e.g. log piles) may be possible (Stanisic in TSSC 2016). Movement patterns of Australian land snails are poorly studied. Ridgeway *et al.* (2014) studied the behavioural ecology, including movement patterns, of several species of camaenid land snails in the Sydney region of New South Wales (NSW). These species were *Pommerhelix duralensis*, *Meridolum corneovirens* and *M. middense* which are comparable in size or a little larger (15-30mm in diameter) than Dulacca Woodland Snail. The study of Ridgeway *et al.* (2014) found that these snails moved only short distances during any one observation (often <1m) and that the longest recorded movement was 3.5 m out of 50 survey-animal nights. Ridgeway *et al.* (2014) also concluded that the very low dispersal rates recorded for two of the species suggested that they are highly susceptible to habitat fragmentation. Although not confirmed by field studies, it is probable that Dulacca Woodland Snails also move short distances and that they are equally as susceptible to habitat fragmentation through the creation of isolated populations.

2.8 Breeding Biology

Nothing is known of the breeding biology of Dulacca Woodland Snail other than that a captive population produced a clutch of 20 eggs (Eddie in TSSC 2016). It is assumed, like other camaenid land snails, that it lays its eggs in depressions in soil under logs and other ground debris; multiple egg laying events per season are possible depending on the frequency and timing of weather events (Stanisic in TSSC 2016). Although not confirmed, the species is expected to reach sexual maturity during its second wet season.

Land snail eggs are prone to desiccation therefore an overstorey of trees and shrubs, in addition to ground shelter sites (e.g. logs and other debris), is considered critical to maintaining high levels of humidity at potential egg-laying sites (Stanisic in TSSC 2011).

2.9 Feeding Ecology

Nothing is known of the food or feeding ecology of Dulacca Woodland Snail. Like other camaenid land snails it is presumed to feed at night after rain upon hyphae and fruiting bodies of native fungi, lichen, algae and other detritus/biofilm among ground debris (Stanisic in TSSC 2016).

3. Methodology

3.1 Desktop & Literature Review

The following data and information sources were reviewed to inform this survey:

- ✦ DEE Protected Matters Search Tool (PMST) (DEE 2019a);
- ✦ DEE Species Profile and Threats Database (SPRAT) (DEE 2019b);
- ✦ Atlas of Living Australia database (ALA 2019);
- ✦ Queensland Museum fauna specimen database (Queensland Museum 2019);
- ✦ State government regional ecosystem (RE) mapping (DES 2018);
- ✦ State government Wildlife Online database (DES 2019c);
- ✦ State government Essential Habitat mapping (DES 2019d);
- ✦ Ground-truthed RE mapping (AECOM 2019a, b);
- ✦ Client-supplied ecology survey reports for the Study Area;
- ✦ Relevant published and other publicly available literature; and
- ✦ Satellite imagery for the Study Area (Google Earth, Queensland Globe).

3.2 Field Survey

3.2.1 Land Snail Searches

3.2.1.1 Selection of field survey sites

Field survey sites were selected after examination of relevant imagery within the following parts of the Study Area:

- ✦ Client-identified disturbance area polygons;
- ✦ Potential offset area options; and
- ✦ Areas of unmapped vegetation that could represent potential habitat for Dulacca Woodland Snail.

3.2.1.2 Survey method

In the absence of species-specific survey guidelines for Dulacca Woodland Snail standard terrestrial land snail survey techniques (e.g. Stanisic *et al.* 2010, Cameron and Pokryszko 2005) and recommendations within the Conservation Advice (TSSC 2016) for Dulacca Woodland Snail were followed. The Conservation Advice provides the following survey guidelines:

- ✦ The species “lives under forest debris and is best detected by turning logs and raking accumulated leaves”.
- ✦ “The best times for survey are during the months of summer storms and rain (generally October to March)”.
- ✦ “Given the difficulty with night observation of snails in their habitat, daylight searching can be equally effective”.
- ✦ “Survey effort should be at least two person hours targeting areas of preferred snail microhabitat”.

Surveys for the target species conformed to the survey guidelines in the following ways:

- ✎ The field survey was conducted in October which falls within the preferred survey period of October – March.
- ✎ Active searching of potential shelter sites within a range of vegetation types was the primary search method.
- ✎ Each site within proposed clearing impact areas was searched for a minimum of two person hours (which included as much of each habitat in which the survey site was located) unless all microhabitat at the survey site was searched in less time.

Active searching included rolling logs and other ground debris, checking the inside of hollow logs, overturning rocks/rock piles, lifting fallen bark piles and raking dense patches of leaf litter. The undersides and hollows of logs were checked for aestivating live snails, while the top few centimetres of soil beneath logs was raked to detect whole shells or fragments of dead snails. Note that active searching was carefully undertaken to minimise microhabitat disturbance at all survey sites. The location (and number of shells) of *Dulacca Woodland Snail* (where detected) was captured by Global Positioning System (GPS) and recorded electronically for incorporation into relevant Geographic Information System (GIS) layers.

A sample (at least one L per site) of surface soil and leaf litter was collected from under logs or around the bases of trees from each survey site for post-field laboratory sorting. Leaf litter samples were sieved and searched for shells of dead land snails under a stereo microscope. This additional search technique (e.g. Stanisic *et al.* 2010) was useful to detect juvenile snails and shell fragments where shells of the target species were not otherwise detected during active searches. Any land snails extracted from leaf litter samples were identified to species level.

Nocturnal searches were not undertaken as live snails were not necessary to confirm presence within the Study Area i.e. the species was readily detected by the presence of dead shells. As per the Conservation Advice (TSSC 2016), the presence of dead shells was assumed to be an indicator of living specimens.

Voucher specimens of land snails from each survey site were retained for deposition in the Queensland Museum Malacology Section reference collection. Land snails were collected under Scientific Purposes Permit SPP19-002164.

Land snail taxonomy within this report follows Stanisic *et al.* (2010) and (Stanisic *et al.* 2017).

3.2.1.3 Identifying the target species

Dulacca Woodland Snail was readily distinguished from all other species of land snail present in the Study Area by the shape and size of the shell. However, shape and size of the shell is variable and the *Dulacca Woodland Snail* is superficially similar to several undescribed species in the family Camaenidae which overlap with the broader range of the *Dulacca Woodland Snail* in the Brigalow Belt. As such size, colour and shape of the shell are not reliable identification characters on their own (C. Eddie pers. obs.). All specimens of *Adclarkia* were distinguished from other undescribed (and potentially confusing) species of Camaenidae by examining differences in microsculpture on the shell surface. This was undertaken by examining voucher specimens under a stereo microscope in the laboratory. All *Adclarkia* are sculptured with fine, elongate pustules each with a raised periostracal scale on the teleoconch (Stanisic *et al.* 2010). This feature is absent from shells of the undescribed Brigalow Belt camaenids, hence examination of shell microsculpture was the primary method of identification.

3.2.2 Habitat Assessments

3.2.2.1 BioCondition Assessment

Detailed habitat assessments were conducted at impact area survey sites and potential offset area options within the Study Area. Within these areas the BioCondition methodology was employed to describe and measure the habitat and microhabitat values of each site in accordance with the methodology described in *BioCondition Assessment Manual* Version 2.2 (Eyre *et al.* 2015). As per the BioCondition methodology, each site was assessed upon its attributes that act as indicators of habitat quality and ecosystem function.

These attributes included, but were not limited to, the following:

- ✎ Large trees;
- ✎ Tree canopy height;
- ✎ Recruitment of dominant canopy species;
- ✎ Native tree and plant species richness;

- ✎ Tree canopy cover;
- ✎ Shrub cover;
- ✎ Coarse woody debris;
- ✎ Non-native plant cover;
- ✎ Native perennial grass cover; and
- ✎ Organic litter.

BioCondition data was captured using mobile GIS devices (Motion tablet) and entered into a project-specific field assessment spreadsheet. Representative photographs were taken at each assessment site. Regional ecosystem type at each survey site was confirmed during the field inspection as per REDD (DES 2019b).

3.2.2.2 Other Habitat Assessments

Due to the time-consuming nature of BioCondition assessments, a simplified habitat assessment was undertaken at survey sites which were primarily for ground-truthing of potential snail habitat. At these sites a less detailed assessment of vegetation, microhabitat characteristics and disturbances was made. Vegetation and microhabitat variables were assessed within a 50 m x 10 m plot using a modified quaternary-level assessment as described in Neldner *et al.* (2017) to record vegetation structure and floristics and to identify the RE present. Parameters assessed included:

- ✎ height (median and maximum/minimum) and % cover of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
- ✎ dominant flora in each stratum of vegetation;
- ✎ RE type observed;
- ✎ landform; and
- ✎ soil type.

Within each habitat assessment plot, a range of habitat/microhabitat features were recorded including:

- ✎ abundance of logs in various size classes;
- ✎ abundance of hollow-bearing trees (including various hollow-size categories);
- ✎ abundance of rocks/stones;
- ✎ abundance of logs/trees with decorticated (loose) bark;
- ✎ density of leaf litter;
- ✎ density of shrub layer;
- ✎ density of ground layer; and
- ✎ abundance and characteristics of gilgais.

Disturbances (and their severity) recorded at each survey site included clearing (including historical), logging, grazing, feral animal diggings/wallows, fire and storm damage.

3.2.3 Habitat Mapping

A desktop assessment was conducted to review existing habitat mapping (AECOM 2019a) for Dulacca Woodland Snail. This review determined the presence and extent of potentially suitable habitat for Dulacca Woodland Snail within the Study Area. This involved a desktop review of existing mapped snail habitat and comparison with known habitat requirements of the species. Any additional unmapped potential habitat was identified and consideration was given to ground-truthing this habitat where this could not be ascertained during the desktop assessment. The results of the desktop assessment and ground-truthing of both previously mapped and unmapped habitat was used to produce refined predictive mapping of suitable habitat areas (and types) within the Study Area.

4. Results

4.1.1 Desktop Searches

Although a limited amount of land snail survey has been undertaken in parts of the Study Area (Stanisic 1998) no targeted surveys specifically for Dulacca Woodland Snail have been previously undertaken. Previous land snail surveys (Stanisic 1998) were focussed on the ridge within the central part of the Study Area (to the immediate north of the Warrego Highway) which resulted in the discovery and subsequent description of Dulacca Woodland Snail. No

targeted land snail surveys were performed as part of previous fauna surveys within the Study Area (AECOM 2019a, Ecology and Heritage Partners 2018).

Publicly accessible database records for Dulacca Woodland Snail within the Study Area are shown within Appendix C. These records are derived from searches of the Atlas of Living Australia (ALA 2019) and Queensland Museum (QM 2019) databases. No records of Dulacca Woodland Snail were obtained from a Wildlife Online (DES 2019c) database search.

The desktop search results show that the Dulacca Woodland Snail has previously been recorded from the Study Area (ALA 2019, QM 2019). The Study Area contains the type locality for the species i.e. the place where the specimens used to formally name the species were found. The type locality is described by Stanisic *et al.* (2010) as “rocky peak, c. 9.7km E of Dulacca”. This equates to the southern end of the low ridgeline within the central part of the Study Area on the northern side of the Warrego Highway (Appendix A). Note that the precision of the co-ordinates at the type locality (Appendix C) is 500 m (ALA 2019).

Essential Habitat (EH) for the Dulacca Woodland Snail is mapped by DES within the Study Area (DES 2019d). This is located along the Warrego Highway and extends northwards to include vegetation on the main ridge line within the Study Area. No EH is mapped within the Project Layout.

4.1.2 Targeted Searches

Existing desktop data was not adequate to address matters relating to Dulacca Woodland Snail within the Study Area hence a targeted survey was performed as part of this study.

The field survey had the following objectives:

- ✎ To confirm presence of the Dulacca Woodland Snail within the Study Area, particularly within nominated potential impact and offset areas;
- ✎ To obtain information relating to habitat use by Dulacca Woodland Snail within the Study Area, particularly at proposed disturbance sites and in potential offset areas;
- ✎ To incorporate the results of field surveys within documentation necessary for submission to DEE including revised habitat mapping and impact assessments.

The field survey was undertaken over a four-day period from 8 to 11 October 2019. Weather conditions included warm to hot days and mild nights. No rainfall occurred during the survey period, however a rainfall event occurred prior to the survey on 02 October 2019. Unofficial landholder rainfall reports for this rain event ranged from 3 to 30 mm across the Study Area. Prior to the survey, rainfall within the Dulacca region had been well below average over the past year. Despite the survey being undertaken in drought conditions, this was not considered to affect the survey results as Dulacca Woodland Snail was easily detected by empty shells.

Targeted searches for Dulacca Woodland Snail were undertaken at 19 survey sites. The location of each survey site is shown within Appendix D and descriptive notes for each survey site are shown in Appendix E.

Sixteen (16) species of land snail were recorded within the Study Area (Table 1).

Table 1: Land snails detected within the Study Area.

Family	Scientific Name	Common Name	Status EPBC Act	Status NC Act
Camaenidae	<i>Adclarkia dulacca</i>	Dulacca Woodland Snail	Endangered	Endangered
Camaenidae	<i>Eurytrachia mucosa</i>	Wide-ranging Squat Snail	Not listed	Not listed
Camaenidae	<i>Neveritis aridorum</i>	Nomadic Velvet Snail	Not listed	Not listed
Camaenidae	<i>Neveritis misella</i>	Mid-eastern Velvet Snail	Not listed	Not listed
Camaenidae	<i>Pallidelix chinchilla</i>	Chinchilla Woodland Snail	Not listed	Not listed
Helicarionidae	Helicarionidae sp. nov. (undescribed species)	-	Not listed	Not listed
Punctidae	<i>Paralaoma morti</i>	Mort's Pinhead Snail	Not listed	Not listed
Pupillidae	<i>Cylindrovertilla hedleyi</i>	Hedley's Amber Pupasnail	Not listed	Not listed

Family	Scientific Name	Common Name	Status EPBC Act	Status NC Act
Pupillidae	<i>Gastrocopta hedleyi</i>	Brigalow Pupasnail	Not listed	Not listed
Pupillidae	<i>Gastrocopta pediculus</i>	Weakly Toothed Pupasnail	Not listed	Not listed
Pupillidae	<i>Pumilicopta bifurcata</i>	Many-toothed Pupasnail	Not listed	Not listed
Pupillidae	<i>Pupisoma porti</i>	Tall Toothless Pupasnail	Not listed	Not listed
Pupillidae	<i>Pupoides pacificus</i>	Single-toothed Pupasnail	Not listed	Not listed
Rhytididae	<i>Scagacola brigalow</i>	Brigalow Carnivorous Snail	Not listed	Not listed
Subulinidae	<i>Eremopeas tuckeri</i>	Tucker's Awlsnail	Not listed	Not listed
Succineidae	<i>Austrosuccinea macgillivrayi</i>	MacGillivray's Ambersnail	Not listed	Not listed

Dulacca Woodland Snail was detected at 15 of the 19 survey sites (Appendix F, Table 2).

Table 2: Summary of sites where Dulacca Woodland Snail was detected with search effort for each site.

Site No.	Search Effort (person mins)	Dulacca Woodland Snail Detected	No. of live individuals	No of dead shells
DU01	150	No	0	0
DU02	70	No	0	0
DU03	70	Yes	0	2
DU04	150	No	0	0
DU05	180	Yes	0	8
DU06	130	Yes	0	24
DU07	240	Yes	1	54
DU08	90	Yes	2	11
DU09	90	Yes	0	2
DU10	90	Yes	0	15
DU11	30	Yes	0	4
DU12	30	Yes	0	8
DU13	30	Yes	0	5
DU14	30	No	0	0
DU15	30	Yes	0	6
DU16	30	Yes	0	1
DU17	30	Yes	0	8
DU18	180	Yes	0	2
DU19	150	Yes	0	5
Total	1800	15/19	3	155

Despite the prevailing drought conditions both live and dead Dulacca Woodland Snails were detected. Although it was not the intention of the survey to detect live individuals, three live Dulacca Woodland Snails were encountered during diurnal hand searches (i.e. by rolling logs). Approximately 155 dead Dulacca Woodland Snails were also found. Representative voucher specimens (dead shells only) were retained for the Queensland Museum from each survey site. The survey methodology was consistent with the TSSC (2016) guidelines i.e. the survey was conducted within a suitable time of year (i.e. between October – March) and searches within clearing impact areas were at least two

person hours per site unless the species was detected in less time or all microhabitat at the survey site had been searched in less time.

Dulacca Woodland Snail was not detected at four of the 19 survey sites. One of these sites (DU01) was Narrow-leaved Ironbark (*Eucalyptus crebra*) woodland which had an open canopy and very little microhabitat. Two sites (DU02, DU03) were regrowth of Scrub Wattle (*Acacia tenuinervis*) and Brigalow (*A. harpophylla*) respectively which had good canopy cover but contained few microhabitat features. The fourth site (DU14) was located within semi-evergreen vine thicket (SEVT) which was difficult to search entirely within the time available due to the presence of boulder piles and deep rock crevices. For the purposes of potential habitat mapping presence of the snail has been assumed within all of these habitat patches as absence could not be ruled out.

Numbers of live and dead individuals of Dulacca Woodland Snail detected at each survey site are shown within Table 2. No estimates of the total population size of Dulacca Woodland Snail can be made within the Study Area without survey of live individuals; this would require further field work at night after rain. Regardless, it is clear from the presence of dead shells that Dulacca Woodland Snail is distributed throughout the Study Area wherever potentially suitable RE and microhabitat is present, and that the Study Area supports a significant population of the species.

4.1.3 Habitat Mapping

4.1.3.1 Existing Habitat Mapping

Previous ecological surveys identified three remnant RE types in the Study Area (AECOM 2019a, b) these being:

- ✎ RE 11.7.1: *Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *Eucalyptus microcarpa* woodland on lower scarp slopes on Cainozoic lateritic duricrust.
- ✎ RE 11.7.6: *Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust.
- ✎ RE 11.9.5: *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks.

A small area (13.2 ha) of High Value Regrowth (HVR) of RE 11.9.5 was also mapped, as was a fourth vegetation type this being “non-remnant vegetation” which included cleared areas other than cropped lands (AECOM 2019a, b).

All occurrences of the three remnant RE types and HVR 11.9.5 within the Study Area were mapped as potential habitat for Dulacca Woodland Snail by AECOM (2019a). Approximately 670.1 ha of potential habitat was mapped for the species in the Study Area.

4.1.3.2 Refined Habitat Mapping

The field survey confirmed the following remnant and/or regrowth habitat types were present within the Study Area:

- ✎ RE 11.7.1: *Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *Eucalyptus microcarpa* woodland on lower scarp slopes on Cainozoic lateritic duricrust.
- ✎ RE 11.7.6: *Corymbia citriodora* or *Eucalyptus crebra* woodland on Cainozoic lateritic duricrust.
- ✎ RE 11.9.5: *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks.

The field survey also detected two additional RE types which were not previously recognised from the Study Area these being:

- ✎ RE 11.7.1x1: Semi-evergreen vine thicket on Cainozoic lateritic duricrust.
- ✎ RE 11.9.1: Open forest to woodland of *Eucalyptus thozetiana* and *Acacia harpophylla* on fine-grained sedimentary rocks.

The field survey detected Dulacca Woodland Snail in all remnant and/or regrowth RE types within the Study Area (Appendix E). As a result, the previously mapped habitat for Dulacca Woodland Snail was used as a basis to further refine habitat mapping for the species. Patches of unmapped habitat were identified prior to the field survey and a range of these were sampled to confirm if Dulacca Woodland Snail was present. As the Dulacca Woodland Snail was detected at multiple sites within previously unmapped habitat, additional areas of potentially suitable habitat were mapped (using both imagery interpretation and field observations). Habitat was considered potentially suitable wherever tree and/or shrub canopy was present and relatively intact and suitable microhabitat (e.g. logs, rocks) was present or potentially present. Refined habitat mapping for Dulacca Woodland Snail in the Study Area is presented in Appendix G.

Refined habitat mapping indicated that approximately 765.2 ha of potential habitat for Dulacca Woodland Snail occurs in the Study Area (Table 3) compared to 670.1 ha as previously mapped by AECOM (2019a).

Table 3: Summary of habitat types based on refined mapping for Dulacca Woodland Snail within the Study Area.

RE Code	RE Short Description (based on REDD modified with field observations)	Area – remnant (ha)	Area – regrowth (ha)	Total Area (ha)
11.7.1	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> and <i>Eucalyptus thozetiana</i> or <i>Eucalyptus woollsiana</i> woodland on lower scarp slopes on Cainozoic lateritic duricrust.	2.7	13.7	16.4
11.7.1x1	Semi-evergreen vine thicket on Cainozoic lateritic duricrust	36.8	0.0	36.8
11.7.6	<i>Eucalyptus crebra</i> woodland on Cainozoic lateritic duricrust	501.4	4.3	505.7
11.9.1	Open forest to woodland of <i>Eucalyptus thozetiana</i> and <i>Acacia harpophylla</i> on fine-grained sedimentary rocks	13.7	9.9	23.6
11.9.5	<i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest on fine-grained sedimentary rocks	127.3	55.4	182.7
TOTAL		681.9	83.3	765.2

Habitat mapping was categorised as ‘Confirmed’ where Dulacca Woodland Snail was confirmed to be present (either during this study or where mapped habitat contained the type locality), and ‘Potential’ in areas that were not necessarily searched but the RE type is potentially suitable. 83.7 ha of Confirmed Habitat and 681.5 ha of Potential Habitat were mapped for Dulacca Woodland snail within the Study Area (Appendix G).

Note that although additional habitat was mapped for Dulacca Woodland Snail in the Study Area, most of the habitat is fragmented and there are limited opportunities for dispersal between patches due to the low mobility of the species and presence of potential barriers such as roads. Likewise, many small patches are susceptible to edge effects and other threats such as clearing, microhabitat loss, weed invasion and wildfire.

All mapped habitat is potentially suitable for breeding, foraging and dispersal by Dulacca Woodland Snail hence maps separating breeding, foraging and dispersal habitat are not required for the species.

4.1.4 Habitat Quality

Two types of habitat assessment were undertaken at survey sites within the Study Area. BioCondition assessments were undertaken within 100 m x 50 m plots at each potential impact site (survey sites DU01, DU07, DU08, DU12, DU18) and at representative locations within each potential offset area option (survey sites DU04, DU05, DU06, DU19) (Appendix D). Other habitat assessments (including descriptions of vegetation, microhabitat features and disturbances) were undertaken within 50 m x 10m plots at all other survey sites. Full data for BioCondition assessments has been provided separately to this report and has been used to calculate habitat quality scores.

BioCondition assessments showed that the Study Area supports high quality habitat for Dulacca Woodland Snail.

5. Impact Assessment

5.1.1 Threats to the Species

Threats to Dulacca Woodland Snail identified by TSSC (2016) are summarised as follows:

- ✎ Habitat loss and fragmentation:
 - Broad-scale removal of woody vegetation due to clearing for agriculture, mining and infrastructure (e.g. roads, powerlines)
 - Fine-scale removal of microhabitat such as stick-raking and burning of timber piles or removal of timber for firewood
- ✎ Invasive species:
 - Predation by rats, mice and feral pigs – all are known to prey upon land snails
 - Invasion of Buffel Grass (*Cenchrus ciliaris*) – replaces native grasses and increases fuel load

- ✎ Impacts of domestic species:
 - Trampling by cattle and horses – animals with solid hooves may trample snails or important microhabitat features which provide breeding, feeding and shelter sites
- ✎ Fire:
 - Any fire can potentially remove microhabitat (especially logs and fallen bark) but hot fires are particularly destructive
 - Fire regimes may change and become hotter and more frequent with changes in ground layer composition (e.g. due to Buffel Grass invasion).

All of the above threats, with the exception of rats and mice, were observed during the field survey within the Study Area. These are further described and assessed in section 5.1.2.

Black-striped Wallabies (*Macropus dorsalis*) were abundant in some of the small retained areas of habitat within the Study Area, particularly areas of dense Brigalow regrowth and in SEVT patches. These wallabies favour dense habitats for shelter and presumably forage in the adjoining clearings/cropped areas at night. Areas with highly concentrated numbers of Black-striped Wallabies had almost nil ground layer cover (i.e. forbs/grasses) and had significant areas of bare ground associated with wallaby activity. This resulted in loss of microhabitat (e.g. leaf litter, damage to logs and other shelter sites) for Dulacca Woodland Snail. High abundance of Black-striped Wallabies may therefore represent a previously unidentified threat to dense habitats occupied by Dulacca Woodland Snails (e.g. SEVT, *Acacia harpophylla* regrowth).

Livestock, particularly cattle, are present throughout the Study Area. The detection of Dulacca Woodland Snail throughout the Study Area demonstrates that it is able to persist in grazed landscapes providing that the snail has access to shelter (i.e. some canopy cover and microhabitat features). Cattle impacts were highest where their numbers were concentrated, e.g. in shade lines where this vegetation represented the only shade available for livestock in the paddock. Although it is possible that livestock may trample live snails this is considered to be a lower threat than other factors such as clearing which results in removal of canopy cover and microhabitat.

Evidence of past quarrying was observed in the Study Area (e.g. at 1SP218510) which has resulted in some loss of snail habitat. Coal seam gas (CSG) exploration and extraction activities are occurring in the broader area and this could contribute to further disturbance to or loss of snail habitat should they occur within the Study Area.

5.1.2 Potential Impacts During Project Phases

Based on the identified threats to Dulacca Woodland snail within and outside the Study Area, Table 4 provides an overview of potential impacts during project phases.

Table 4: Impact Assessment for Dulacca Woodland Snail within the Study Area.

Potential Impact	Impact Description and Assessment	Phase of Development			
		Pre-construction	Construction	Operation	Decommissioning & Rehabilitation
Loss of individuals	Loss of individuals of Dulacca Woodland Snail is expected to occur during construction in the five clearing impact areas. Habitat clearing and removal of microhabitat is expected to be the most important factor resulting in loss of individual snails. The number of snails likely to be affected is unknown without conducting nocturnal surveys for the species after rain. Given that field surveys only detected 3 live individuals it is expected that the total number of live snails impacted would be small (i.e. <30). Loss of individuals could potentially occur post-construction due to increased fire risk, increased weed proliferation (particularly Buffel Grass) and desiccation of habitat.		✓	✓	✓

Potential Impact	Impact Description and Assessment	Phase of Development			
		Pre-construction	Construction	Operation	Decommissioning & Rehabilitation
Increased mortality by crushing due to increased vehicle movements	Dulacca Woodland Snail is of low mobility and although no species-specific studies have been undertaken, movements during any one period of activity are unlikely to be any more than a few meters. Roads and other clearings are recognised barriers to land snail movement (e.g. Baur and Baur, 1990) and it is considered unlikely that Dulacca Woodland Snail would cross bitumen and gravel roads. The highest activity period of the snail is likely to be at night after rain. Given that the species is unlikely to cross formed roads and that most vehicle movements will be during the day it is considered unlikely that increased vehicle movements within the Study Area will lead to increased mortality of Dulacca Woodland Snail.	✓	✓	✓	✓
Loss of habitat	The Project Footprint has been designed to avoid and minimise loss of habitat for Dulacca Woodland Snail. Development of the Project will result in potential clearing of approximately 1.49 ha of confirmed Dulacca Woodland Snail habitat. This includes: • approximately 0.78 ha of remnant RE 11.9.5 (<i>Acacia harpophylla</i> woodland-open forest) situated along the Warrego Highway which supports an important population of the species • 0.17 ha of remnant RE 11.9.5 between turbines T30 and T31. • 0.24 ha of regrowth RE 11.7.1 beside turbine T18. • 0.3 ha of remnant RE 11.7.1 (<i>Eucalyptus thozetiana</i>, <i>E. woollsiana</i>, <i>A. harpophylla</i> woodland) beside T16. Although any loss of habitat may have a cumulative impact on the species in an already fragmented landscape, this level of habitat loss is unlikely to be detrimental to the species as a whole. 83.7 ha of confirmed and 681.5 ha of potential habitat will remain undisturbed in the Study Area. No 'habitat critical to the survival of the species' as defined in EPBC Act referral guidelines has been identified for Dulacca Woodland Snail in the Study Area, however for the purposes of this assessment all mapped snail habitat is considered to be important for the species survival. No mapped Essential Habitat will be impacted by the Project.		✓		
Fragmentation of habitat	The Project Footprint has been designed to avoid and minimise fragmentation of habitat for Dulacca Woodland Snail by utilising existing gaps as much as possible (e.g. Warrego Highway access and access track between T30/T31). However, construction of a proposed overhead transmission line will further fragment a roadside strip of Brigalow woodland on the northern side of the Warrego Highway. A 40 m clearing corridor is proposed which will likely represent a barrier to movement for Dulacca Woodland Snail. Field surveys demonstrated that a significant local population was present at this location which could be detrimentally impacted by habitat fragmentation.		✓		

Potential Impact	Impact Description and Assessment	Phase of Development			
		Pre-construction	Construction	Operation	Decommissioning & Rehabilitation
Loss of microhabitat features	There will be unavoidable loss of microhabitat at all proposed clearing impact areas. The two proposed impact areas along the Warrego Highway are both situated in habitat with abundant microhabitat features, particularly logs as well as loose bark and dense leaf litter. Construction activities outside these areas are unlikely to impact upon microhabitat features as the remainder of the Disturbance Footprint is not within mapped snail habitat.		✓		
Desiccation of understorey habitat as a result of edge effects from clearing or disturbance to surrounding habitat	Desiccation of understorey habitat due to clearing has the potential to occur to some degree at all of the proposed clearing impact areas. This is particularly the case at the proposed future overhead line along the Warrego Highway which currently has good canopy and subcanopy cover.		✓	✓	✓
Desiccation or inundation of habitat resulting from changes in hydrology across the project area	Hydrology may be influenced in localised areas by the introduction of hardstands and access tracks; however these will be supported by erosion and sediment control measures. No changes to hydrology are expected within the Project Layout that would result in desiccation or inundation of Dulacca Woodland Snail habitat.		✓	✓	✓
Erosion and sedimentation impacts on habitat	It is not expected that erosion and sedimentation are likely to have an impact on Dulacca Woodland Snail or its habitat.		✓	✓	✓
Increased predation by feral animals (rats, mice)	Rats and mice were not observed during the field survey however they are expected to occur in the Study Area with numbers fluctuating according to seasonal conditions and presence/absence of cereal crops in surrounding paddocks. No dead shells of Dulacca Woodland Snail detected showed any signs of predation by rodents, however rodents may pose a threat to the species during plague periods. Project activities are unlikely to result in any increase in rodent numbers within the Study Area.		✓	✓	✓
Increased predation by feral animals (pigs)	Feral pigs were observed at several survey sites (e.g. DU16, DU19) and pig tracks, wallows and diggings were observed at several other sites across the Study Area. Feral pigs represent a greater threat to Dulacca Woodland Snail than rodents as they destroy/disturb microhabitat as well as potentially trampling and eating live snails. Project activities are unlikely to result in any increase in feral pig activity or numbers.		✓	✓	✓
Introduction and/or proliferation of weeds	Implementation of biosecurity management measures (e.g. vehicle hygiene) will minimise the potential introduction of new weeds within the Project Layout. Construction activities have the potential to increase the proliferation of Buffel Grass particularly at the proposed clearing impact sites. Buffel Grass is present in low densities at each clearing impact sites, however further disturbance is likely to promote further establishment and spread of this species, particularly along the edges of vegetation.	✓	✓	✓	✓

Potential Impact	Impact Description and Assessment	Phase of Development			
		Pre-construction	Construction	Operation	Decommissioning & Rehabilitation
Introduction and/or proliferation of pathogens	Pathogens have not been identified as a threat to Dulacca Woodland Snail.	✓	✓	✓	✓
Increased potential for fire	Evidence of past fire was noted in all habitat types throughout the Study Area. Dulacca Woodland Snail was found at many sites which had evidence of previous fire incursion, including habitats which are more prone to fire (e.g. grassy <i>Eucalyptus</i> woodlands). High intensity fires are likely to remove substantial amounts of microhabitat (particularly logs and fallen bark piles). High intensity fires are therefore likely to be detrimental to the species and could severely impact upon small and fragmented habitat patches. Replacement of native ground layer vegetation by Buffel Grass is likely to result in higher fuel loads and more intense fires, particularly in or at the margins of fire-sensitive communities such as Brigalow woodland/open forest and SEVT.	✓	✓	✓	✓
Dust impact from construction activities and increased vehicle movements	Dust impacts on snail habitat could occur anywhere within the Project Layout as vehicle movements increase during all phases of the project. Construction of roads, turbine pads and other infrastructure may also contribute to dust impacts on adjoining vegetation. Dust impacts upon Dulacca Woodland Snail habitat are unlikely to be significant providing dust control measures are implemented during all phases of project development.	✓	✓	✓	✓

5.1.3 Description of Clearing Impact Areas

The Project is located in a highly modified landscape where much of the original vegetation and habitat has been removed for grazing and cropping. The Study Area contains areas of remnant and regrowth vegetation which have since been either confirmed to support or have the potential to support populations of Dulacca Woodland Snail. The Project Layout largely avoids areas of remnant and regrowth vegetation, which has been achieved through a process of site verification and design refinement (AECOM 2019a).

The field survey described by this report focused on areas of potential direct impact on the species based on the Project Layout provided prior to the survey. The following areas (refer to Appendix D for locations) identified in the desktop assessment were sampled and assessed for potential impacts upon Dulacca Woodland Snail:

- 🦋 **Warrego Highway access** (Survey Site DU08): A detailed habitat assessment (BioCondition site) and search for Dulacca Woodland Snail was conducted in remnant RE 11.9.5 (*Acacia harpophylla*) woodland at the proposed main access point for the Project which follows an existing track. Dulacca Woodland Snail was detected within the proposed disturbance footprint. Previous habitat mapping was refined to include areas of previous disturbance at this location. Although the proposed access follows an existing track additional clearing (0.32 ha) will be required to widen the track to allow for truck access. This will result in a wider gap in the vegetation. Proposed clearing at this site will therefore negatively impact upon Dulacca Woodland Snail at this site due to loss of live individuals (probably <5), loss of habitat (0.32 ha), loss of microhabitat (logs) and potentially increased risk of Buffel Grass invasion.
- 🦋 **Warrego Highway future overhead line** (Survey Site DU07): A detailed habitat assessment (BioCondition site) and search for Dulacca Woodland Snail was conducted in remnant RE 11.9.5 (*Acacia harpophylla*) woodland within a proposed linear clearing corridor (future overhead line) traversing the northern side of the Warrego Highway. Dulacca Woodland Snail was detected within the proposed disturbance footprint. At least 54 dead shells were detected indicating that the site likely supports a significant population of the species. Proposed clearing at this site (0.46 ha) will negatively impact upon the population at this site due to potential loss of individuals (probably <15), loss of habitat (0.46 ha), loss of microhabitat (logs, bark piles), further fragmentation of habitat (40 m corridor) and potentially increased risk of Buffel Grass invasion.

- ✦ **T16** (Survey Site DU18): A detailed habitat assessment (BioCondition site) and search for Dulacca Woodland Snail was conducted in remnant RE 11.7.1 (*Eucalyptus thozetiana*, *E. woollisiana* woodland) within the footprint surrounding proposed turbine T16. Dulacca Woodland Snail was detected under logs within the Project Footprint. A small amount (0.3 ha) of clearing will be required in the vicinity of T16. Due to the limited amount of microhabitat present at this site it is unlikely to result in loss of many live individuals (probably <3) and it is also unlikely that a significant local population of the snail will be negatively impacted. However, proposed disturbance at this site will result in some removal of habitat, minor loss of microhabitat and potentially increased risk of Buffel Grass invasion.
- ✦ **T18** (Survey Site DU03): Searches were conducted in the Project Footprint surrounding T18. Dulacca Woodland Snail was detected in adjoining Brigalow regrowth (RE 11.7.1). A small amount (0.24 ha) of clearing will be required in the vicinity of T18. Due to the limited amount of microhabitat present at this site it is unlikely to result in loss of many live individuals (probably <5) and it is also unlikely that a significant local population of the snail will be negatively impacted. However, proposed disturbance at this site will result in some removal of habitat, minor loss of microhabitat and potentially increased risk of Buffel Grass invasion.
- ✦ **T30-31 access** (Survey site DU09): Searches were conducted in the Project Footprint alongside the proposed access and other infrastructure between T30 and T31. Although an existing gap is present, a small amount (0.17 ha) of additional clearing will be required within remnant Brigalow woodland (11.9.5). Due to the limited amount of microhabitat present at this site it is unlikely to result in loss of many live individuals (probably <5) and it is also unlikely that a significant local population of the snail will be negatively impacted. However, proposed disturbance at this site will further fragment habitat, result in loss of some habitat, minor loss of microhabitat and potentially increased risk of Buffel Grass invasion.

A significant amount of infrastructure layout refinement occurred during the development of documentation for the DEE preliminary information response. This included changes to the Project Layout following the revised Dulacca Woodland Snail habitat mapping which was available immediately after this survey was conducted. Due to refinement of the infrastructure layout approximately 1.49 ha of mapped Dulacca Woodland Snail habitat will potentially be cleared (Table 6). The five proposed clearing impact areas (as described above) are shown in Appendix H and the area likely to be disturbed at each site is summarised in Table 5.

Table 5: Summary of proposed clearing impact locations within the Study Area.

Potential Impact Location	Relevant Survey Site	RE Type	Habitat Quality Notes	Microhabitat Features Present	Total Dulacca Woodland Snail Habitat Disturbance Area (ha)
Warrego Highway (access)	DU08	11.9.5 (remnant)	Good quality habitat within road corridor which is bisected by an existing track. Minimal weed invasion. Good canopy cover. Good microhabitat availability. Live snails present.	Logs, dense leaf litter, piles of fallen bark	0.32
Warrego Highway future overhead line	DU07	11.9.5 (remnant)	Good quality habitat within road corridor with minimal disturbance. Minimal weed invasion. Good canopy cover. Excellent microhabitat availability. Live snails present.	Logs, dense leaf litter, piles of fallen bark	0.46

Potential Impact Location	Relevant Survey Site	RE Type	Habitat Quality Notes	Microhabitat Features Present	Total Dulacca Woodland Snail Habitat Disturbance Area (ha)
T16	DU18	11.7.1 (remnant)	Moderate quality habitat situated on a ridge and adjoining a cleared and cropped area. Minimal weed invasion. Open canopy cover. Limited microhabitat availability.	Logs, dense leaf litter	0.3
T18	DU03	11.7.1 (regrowth)	Moderate quality habitat situated on a ridge and adjoining a cleared. Minimal weed invasion. Good canopy cover. Limited microhabitat availability.	Logs, dense leaf litter	0.24
T30 – 31 access	DU09	11.9.5 (remnant)	Good quality habitat with minimal disturbance along drainage line. Minimal weed invasion. Good canopy cover. Good microhabitat availability.	Logs, log piles, dense leaf litter	0.17
TOTAL					1.49

A number of other potential clearing areas were also assessed during the field survey based on earlier versions of the Project Layout. Subsequent changes to the Project Layout indicate that clearing impacts will be avoided at these locations and no disturbance will be necessary:

- 🦎 **T22 – T23 access** (Survey Site DU01): A detailed habitat assessment (BioCondition site) and search for Dulacca Woodland Snail was conducted in remnant RE 11.7.6 (*Eucalyptus crebra* woodland) which adjoins linear infrastructure between turbines T22 and T23. Although the RE is suitable for Dulacca Woodland Snail the BioCondition assessment showed that canopy/subcanopy cover was low and that little microhabitat (e.g. logs/rocks) was present. A thorough search (150 mins) did not detect Dulacca Woodland Snail at this location. Although the site may not currently support the snail it represented potential habitat should canopy and microhabitat cover increase. The location of proposed infrastructure at this location has been realigned to avoid any disturbance to adjoining remnant vegetation. Therefore, no direct impacts are expected on Dulacca Woodland Snail at this location.
- 🦎 **T25-T27 access** (Survey Sites DU10, DU11, DU12): Searches were conducted at three sites in vegetation beside a proposed access track between turbines T25 and T27. Dulacca Woodland Snail was detected within the Project Footprint at all three survey sites. Subsequent changes to the infrastructure layout have been made (i.e. removal of this access track) which will result in no disturbance to these populations. Therefore, no direct impacts are expected on Dulacca Woodland Snail at this location.
- 🦎 **T07-08** (no survey site): An area of intact RE 11.9.5 was identified between turbines T07 and T08. No search was conducted at this site for Dulacca Woodland Snail, however the RE was suitable and microhabitat features (logs) were present. Disturbance to this vegetation was subsequently avoided by relocating infrastructure to the west and utilising an existing gap in the Brigalow shade line.

Other changes were made to the Project Layout subsequent to this survey being conducted such as relocation of the access track between T05 and T12 and the deletion of the access track between T27 and T26/T28. These changes do not have any impact of Dulacca Woodland Snail habitat.

5.1.4 Residual Risk Characterisation

As the species has fragmented populations and has limited mobility (i.e. little ability to recolonise other habitat) the loss of and/or further fragmentation of habitat is likely to have a negative impact on the species. A previous Significant Residual Impact Assessment determined that the Project may have a significant residual impact on Dulacca Woodland Snail (AECOM 2019a). The Significant Residual Impact Assessment for Dulacca Woodland Snail previously undertaken by AECOM (2019a) has been modified and updated in Table 6 to incorporate findings derived from this study.

Table 6: Significant Residual Impact Assessment for Dulacca Woodland Snail within the Study Area.

Impact Criteria	Assessment
An action is LIKELY to have a significant residual impact on habitat for an animal that is 'Endangered', 'Vulnerable' or 'Near Threatened' wildlife if the action will:	
Lead to a long-term decrease in the size of a local population	Dulacca Woodland Snail was identified throughout the Study Area during the field survey. The estimated number of mature individuals is between 251 and 1,000 (TSSC 2016). The Project Footprint has been modified to largely avoid mapped snail habitat. Unavoidable impacts will result in the removal of approximately 1.49 ha of mapped snail habitat. Although no counts of live individuals have been undertaken, it is estimated that the clearing impact areas would collectively contain no more than 30 live individuals. Loss of these individuals will contribute to a long-term decrease in the size of the Warrego Highway population.
Reduce the extent of occurrence of the species	The Extent of Occurrence (EOO) for Dulacca Woodland Snail was calculated to be 8,248 km ² (TSSC 2016). The species was identified at multiple locations within the Project Footprint during the field survey. Although the distribution of the species is highly fragmented, and the Study Area supports a significant local population of the species, the Project will not further reduce the extent of occurrence of the species.
Fragment an existing population	Dulacca Woodland Snail was identified at multiple locations within the Project Footprint. Although planning has largely avoided placement of infrastructure within mapped snail habitat, the Project will fragment an existing population. The population situated along the Warrego Highway will be most severely impacted and will be further fragmented by the Project.
Avoid genetically distinct populations forming as a result of habitat isolation	Dulacca Woodland Snail has very limited mobility, and the capacity for dispersal is therefore also very limited. The potential habitat within the Project Footprint is already severely fragmented by roads, fence lines, a rail line, electricity lines and other infrastructure. The Project will largely not create additional barriers to movement between habitat patches as existing barriers are present and unlikely to be utilised. Infrastructure has been designed to avoid dissecting habitat patches wherever possible. The Project is unlikely to further contribute to genetically distinct populations forming as a result of habitat isolation.
Result in invasive species that are harmful to an endangered, vulnerable or near-threatened species becoming established in the endangered, vulnerable or near-threatened species' habitat	Predation by invasive species (e.g. rats, mice and pigs) has been identified as a key threat to this species, as well as Buffel Grass (<i>Cenchrus ciliaris</i>) invasion. All of these species are currently present within the Study Area. It is unlikely that the Project will exacerbate invasive fauna beyond current levels. However, it is likely that Buffel Grass invasion may be promoted within mapped snail habitat. Pest and weed management measures will be developed to mitigate and manage the potential spread of pest flora and fauna species. Species-specific management will be undertaken for identified key weed and pest species at risk of spread through Project activities. Control efforts will be increased in areas particularly sensitive to invasion (e.g. Warrego Highway).
Introduce disease that may cause the population to decline	Disease has not been identified as a threat to Dulacca Woodland Snail. Biosecurity measures will be implemented to prevent the introduction and spread of disease.
Interfere with the recovery of the species	There is no adopted recovery plan for the species. However, the primary conservation action is listed as: prevent land clearing and resulting habitat destruction at all known localities. Given that the species has been identified within the Project Footprint the Project may interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	All potentially suitable habitat with adequate canopy cover and ground debris is considered critical habitat for breeding, feeding and dispersal. The Project may cause disruption to at least one ecologically significant location for the species, this being the population occurring along the northern side of the Warrego Highway.

In summary, the Project is likely to have a significant residual impact on Dulacca Woodland Snail on the following basis:

- ✦ The Project could lead to a long-term decrease in the size of a significant local population (Warrego Highway).
- ✦ The Project will fragment an existing population (Warrego Highway) which may also result in an increase in invasive species that may become established in the species' habitat.
- ✦ The Project may interfere with the recovery of the species.
- ✦ The Project will cause disruption to an ecologically significant location (breeding, feeding, and shelter sites) of the species.

6. Mitigation and Management Measures

Previously identified mitigation measures (AECOM 2019a) identified for Dulacca Woodland Snail have included pre-clearance surveys prior to vegetation removal, avoidance of habitat (where possible), and translocation of individuals and microhabitat (e.g. logs) to areas of retained habitat. These mitigation measures are discussed below.

Avoidance of Habitat

As habitat loss is the single biggest threat to the species (TSSC 2016), avoidance of habitat is considered to be the most important mitigation measure to ensure persistence of the Dulacca Woodland Snail in the Study Area. Changes to the Project Layout and re-siting of infrastructure have reduced the clearing impact area to 1.49 ha. This represents a significant reduction in the amount of habitat that will potentially be disturbed by the Project.

Pre-clearance Surveys

Pre-clearance surveys are usually conducted prior to construction to identify potential shelter/breeding places for target fauna. If conducted for Dulacca Woodland Snail diurnal search activities such as rolling logs, raking leaf litter and searching bark piles could result in the detection of Dulacca Woodland Snails. However, due to the difficulty of detection of live individuals during diurnal searches (e.g. only 3 live individuals were detected during 1800 mins of searching during this survey), especially if undertaken by untrained personnel, pre-clearance surveys are unlikely to result in the detection of many live individuals.

Salvage Translocation of Individuals

Salvage translocation relates to the relocation of animals from an area adversely affected by a proposed development to an area protected from ongoing impacts. There are few published studies relating to translocation of land snails world-wide. Although some attempts at salvage translocation of threatened Australian land snails (e.g. *Meridolum corneovirens*, *Pommerhelix duralensis*) have been attempted the success of these translocations has not been reported. Translocation of land snails in New Zealand has had mixed success (Stringer *et al.* 2017), with considerable losses of translocated individuals; however, in this case the species translocated were large, long-lived species and their ecology/biology may not be relevant to Dulacca Woodland Snail.

Given that the number of live Dulacca woodland Snails likely to be present within the proposed clearing impact area is not known, potential translocation is of unknown benefit to the species. The EPBC Act 1999 Policy Statement on Translocation of Listed Threatened Species (DSEWPC undated) states that "salvage translocation is usually not effective and in general terms, prospects of successful translocation of individual plants or animals are usually poor". Furthermore, the Policy states that "the high risks associated with translocation proposals generally means that, unless it can be shown that there is a high degree of certainty that a particular translocation attempt will be successful, the proposed removal of individuals of a species from a site should be considered as equivalent to the loss of those individuals".

As the number of live snails within the clearing impact area (1.49 ha) is likely to be low (<30 individuals), and there can be no guarantee of a high probability of long-term success (due to potential relocation of individuals into already fragmented habitat), translocation of live individuals is not recommended as a mitigation measure in this instance.

Salvage Relocation of Microhabitat

As the loss of microhabitat has been identified as a threat to the species (TSSC 2016) the salvage of microhabitat (e.g. suitable logs, fallen bark) from proposed clearing areas and relocation to adjoining microhabitat could be beneficial to populations of *Dulacca Woodland Snail*. This may provide additional breeding and shelter habitat and could help to increase numbers of the species along the Warrego Highway. However, movement of microhabitat features should only occur from proposed clearing impact areas to immediately adjoining habitat to minimise the risk of introduction of new weeds. Most microhabitat within the proposed clearing impact areas is relatively small and could be hand carried. Disturbance from machinery to intact habitat should not occur as a result of microhabitat relocation.

A summary of proposed mitigation and management measures is provided in Table 7.

Table 7: Summary of potential impacts and proposed mitigation measures for Dulacca Woodland Snail within the Study Area.

MNES	EPBC Act status	Likelihood assessment	Management objective	Risk	Mitigation / Management Measure	Residual risk level	Performance indicators	Monitoring activity	Trigger action response plan or corrective action
Dulacca Woodland Snail (<i>Adclarkia dulacca</i>)	Endangered	Confirmed occurrence within the Study Area.	To minimise disturbance to Dulacca Woodland Snail habitat and ensure no decline in population size.	- Habitat loss - Microhabitat removal - Individual mortality during clearing - Increased mortality by crushing due to increased vehicle movements - Weed spread (buffel grass). - Increased fire risk - Pathogen introduction - Desiccation of vegetation	- Refine layout and micro-siting of infrastructure to avoid habitat where possible - Limit disturbance of habitat to approved areas - Relocation of microhabitat from clearing areas to adjoining habitat - Restrict vehicle movements to approved roads and access tracks - Avoid vehicle movement at night and during wet weather - Demarcation of no-go zones and extent of works - Machinery turnaround areas during construction to be placed within clearings so as to avoid disturbance to intact habitat - Erosion and sediment control - Weed management measures including monitoring, treatment and vehicle hygiene - Biosecurity management measures to limit introduction of pathogens - Preparation of fire management measures - Dust suppression - Education materials - Rehabilitation.	HIGH	- Micro-siting does not result in additional disturbance to habitat above approved areas and limits - Habitat features (i.e. logs and other suitable microhabitat) are relocated to adjacent habitat - No exceedance of clearing limits - Disturbance is limited to the disturbance footprint - No loss or decline in threatened fauna population sizes from the balance population size remaining after construction - No movement of Project vehicles into areas of mapped snail habitat - Vehicle/machinery turn-around points are located away from intact habitat - No decrease in retained vegetation condition compared to baseline condition, except where similar condition decline is evident in control sites - No introduction or spread of weed species within the site and successful removal of weed species within the disturbance footprint - No increase or spread of Buffel Grass within clearing impact areas - No dust or desiccation impacts on snail habitat - No erosion or sedimentation impacts on habitat - No fires on site through implementation of Fire Management Plan and other measures to reduce risk of fire - Education materials prepared for use in construction activities - Successful progressive stabilisation of disturbed areas and rehabilitation of the disturbance footprint following construction.	- Baseline habitat condition and photo monitoring (one-off, prior to construction) - Vegetation protection monitoring to ensure no additional clearing or impact beyond extent of works (daily, as required) - Weed management surveys (ongoing) - Rehabilitation monitoring (ongoing until success criteria achieved) - Assess mitigation measures and update Fauna Management Plan where required.	<u>Trigger action response plan:</u> Where clearing/impact has occurred beyond approved clearing limits: - Immediately notify Site Environmental Manager - Cease activity and/or remove equipment from vegetated area - Immediate restoration and rehabilitation of native vegetation. <u>Corrective action:</u> - Re-instate demarcation of extent of works - Rehabilitate damage - Treat deleterious weeds and manage spread - Additional offsets if required - Update Vegetation Management Plan - Re-educate.

7. Offset Area Assessment

As part of the micro-siting process potential impacts to Dulacca Woodland Snail habitat from clearing have been reduced to a low level (i.e. 1.49 ha). As such the need for offsets under the *Environmental Offsets Act 2014* is yet to be determined. As potential offset requirements were not confirmed prior to the field survey, an investigation of four client-nominated potential offset areas was undertaken. This included targeted searches for Dulacca Woodland Snail and BioCondition assessments at each potential offset site (Offset Options A-D). The location of the potential offset areas is shown in Appendix I.

A brief description of each offset area option is provided below.

Offset Option A and B

Offset Options A and B are located in close proximity on 2SP135608. They are retained corridors (shade lines) of remnant RE 11.9.5. Both areas are dominated by Brigalow and/or Belah (*Casuarina cristata*) woodland – open forest. Option A extends is approximately 0.76 km long and 80 m wide (5.61 ha). Option B is approximately 1.27 km long with an average width of about 80 m (9.13 ha). Both have a native shrub understorey but the ground layer is dominated by Buffel Grass. Both vegetation strips are situated on undulating low hills with clay soil. There is currently no connectivity with any adjoining habitat and the strips are surrounded by cropping or grazing land. Logs are numerous at both sites. Dulacca Woodland Snail was detected at both sites.

Offset Option C

Offset Option C is located on 59BWR259. It is an area of approximately 6.31 ha of low Brigalow regrowth (RE 11.9.5). Floristic and structural diversity at the site is low. Ground layer cover is virtually absent. The site is situated on a gently undulating plain with clay soil and some gilgais are present. The regrowth currently has no connectivity with adjoining vegetation. Little microhabitat is available at the site (logs are almost absent). Large numbers of Black-striped Wallabies were observed sheltering in the patch. A search for Dulacca Woodland Snail did not detect the species.

Offset Option D

This site, located on 57BWR199, is located approximately 2.8 km to the northwest of the Study Area. It comprises an area of approximately 7.47 ha of Brigalow regrowth with scattered Mountain Yapunyah (*Eucalyptus thozetiana*) and Gum-topped Box (*E. woollsiana*). This is representative of RE 11.9.1. The site is located on a plain with some gilgai development. Woody debris is scarce but leaf litter is dense in places. The site has connectivity with a large area of adjoining woodland which extends in a south-easterly direction towards the Study Area. Dulacca Woodland Snail was detected within and immediately adjoining the site.

Summary information for each potential offset option (with recommended priority and potential management requirements) is shown within Table 8. BioCondition data for each potential offset area option has been provided separately to this report.

Table 8: Summary information for potential offset options for Dulacca Woodland Snail.

Recommended Priority	Offset Option	Values	Potential Issues	Likely Management Requirements/Measures
1	D	✦ Suitable RE for Dulacca Woodland Snail with opportunity to restore/improve habitat ✦ Contains a confirmed population of Dulacca Woodland Snail ✦ Adjoins large patch of suitable habitat with confirmed population of Dulacca Woodland Snail	✦ Improvement of ground layer and microhabitat availability would be required ✦ Active management of grazing (cattle), wallabies and pigs would be required	✦ Grazing management (periodically exclude livestock to increase ground cover) ✦ Black-striped wallaby management ✦ Feral pig control/management ✦ Fire management ✦ Weed monitoring and management (particularly Buffel Grass invasion) ✦ Increase microhabitat quality and abundance

Recommended Priority	Offset Option	Values	Potential Issues	Likely Management Requirements/Measures
2	A/B	✱ Suitable RE for Dulacca Woodland Snail ✱ Confirmed population of Dulacca Woodland Snail ✱ Excellent microhabitat availability	✱ Strips have no connectivity to other habitat therefore prone to edge effects, desiccation and wildfire ✱ No opportunity to increase extent of habitat in surrounding paddock without major restoration activities ✱ Habitat currently grazed and used as shade camp by cattle (=high cattle impact due to limited shade in surrounding paddock) ✱ Ground layer dominated by Buffel Grass (competes with native flora and increases fire risk)	✱ Fire management – may need fire breaks plus allow for periodic grazing to reduce fuel load due to dominance of ground layer by Buffel Grass ✱ Fire management ✱ Weed management – explore options to reduce cover of Buffel Grass/increase native grass/forb dominance and monitor for other weeds such as Mother-of-Millions ✱ Feral pig control/management ✱ Black-striped Wallaby management
3	C	✱ Suitable RE for Dulacca Woodland Snail ✱ Dulacca Woodland Snail currently absent – habitat currently of very poor quality for any snails (only 1 species recorded at this site)	✱ No Dulacca Woodland Snail present and no opportunity for Dulacca Woodland Snail to recolonize from habitat to west due to clearing and distance ✱ Habitat structure/age not consistent throughout patch – contains highly disturbed areas ✱ Improvement of ground layer and microhabitat availability is required – currently almost nil microhabitat is present ✱ Patch is small and isolated from other habitat due to clearing ✱ Patch supports high numbers of Black-striped Wallabies (=poor ground layer condition due to grazing pressure & trampling/pads)	✱ Fencing to control stock access and increase native grass/forb cover ✱ Weed management – monitor for/control buffel grass invasion ✱ Feral pig control/management ✱ Significant amount of microhabitat augmentation required ✱ Fire management ✱ Black-striped wallaby management

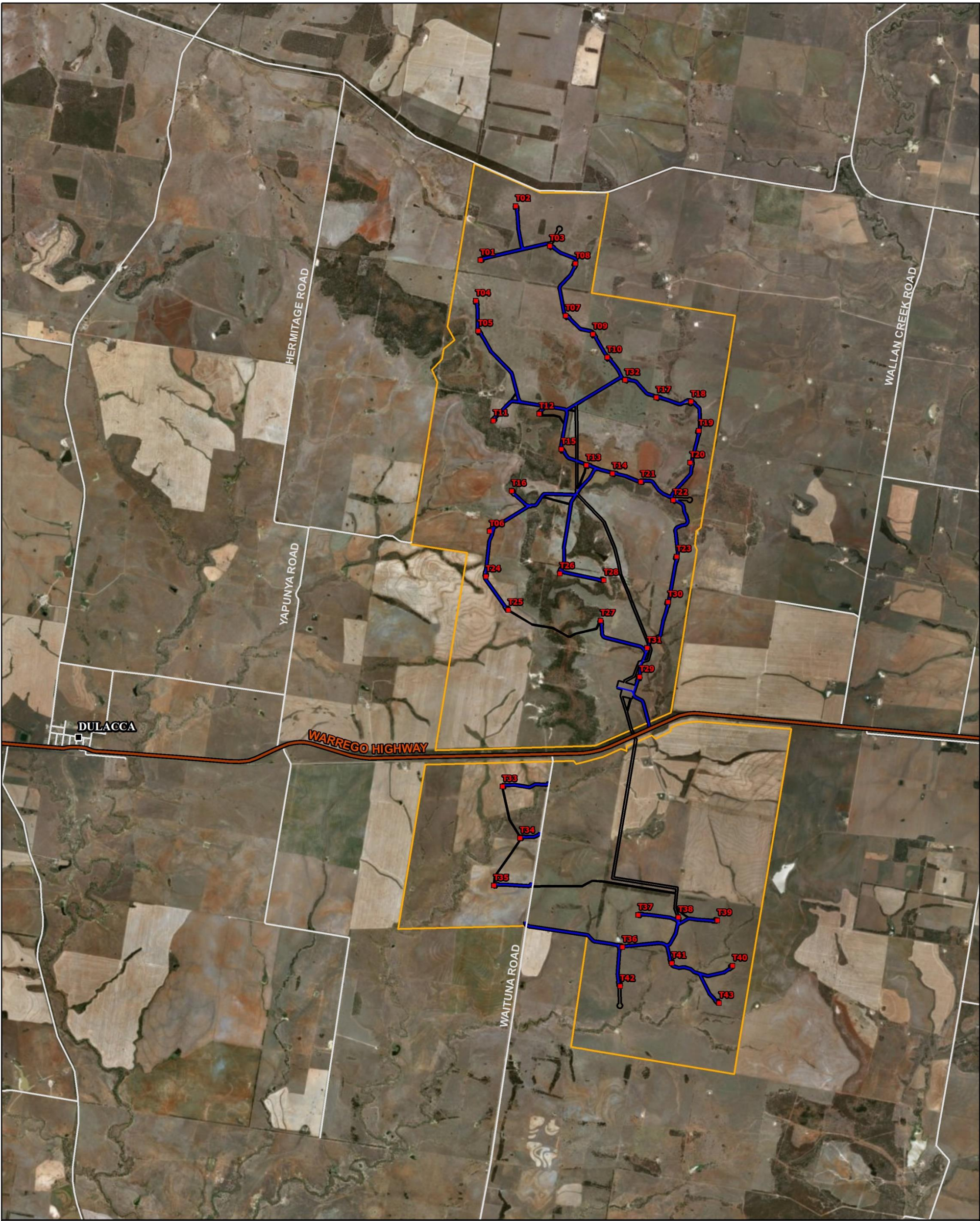
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Appendix A. Location of the Study Area.



Appendix A. Location of the Study Area.

Legend

- | | |
|-----------------------|-----------------------|
| Study Area | Project Layout |
| Disturbance Footprint | Turbine |
| Town | New Road |
| Highway | |
| Local Road | |



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Project: Dulacca
Snail Survey
Map No: PC701-AppA-RevC
Date: 10/11/2019
Drawn: L. Hardwick
Approved: C. Eddie
Scale: 1: 65,000 @ A3
Datum: GDA94



Appendix B. Capability Profile for Lead Project Personnel.

CRAIG EDDIE

Principal Ecologist

CAREER SUMMARY

2000 – Present	Principal Ecologist, BOOBOOK Ecological Consulting
1995 – 2006	Natural Resource Ranger, Qld. Parks & Wildlife Service (Roma)
1994 - 1995	Technician, Qld. Department of Primary Industries (Dalby)
1993 - 1994	Technician, Qld. Museum (Brisbane)

EDUCATION

1993: Bachelor of Applied Science – Natural Systems & Wildlife Management, University of Queensland (Gatton Campus)

2010: Certificate IV Training and Assessment

2010: Diploma of Conservation and Land Management

SPECIAL ACHIEVEMENTS

Hons. 1, Graham Saunders Memorial Award

OTHER RELEVANT TRAINING

Regional Ecosystem Framework: Identification and Classification

PROFESSIONAL EXPERIENCE & SKILLS

Ecological Assessments and Surveys

Ecological surveys (including threatened flora/fauna surveys searches) of >500 infrastructure projects in southern inland Queensland including coal seam gas wells, flow lines, gas plants, roads, access tracks, quarries, camps, major pipelines, seismic lines, fibre optic cables, communication towers, powerline easements and evaporation ponds

Pre-clearance surveys for animal breeding places, rare and threatened flora, Special Least Concern Plants and weeds

11 years of fauna and flora surveys conducted in national parks and other reserves within Roma QPWS management district (Carnarvon, Expedition, Culgoa Floodplain, Alton, Palmgrove, Isla Gorge, Lonesome, Precipice, Thrushton and Narkoola National Parks)

Weed identification, mapping, surveys and management advice

Preparation of fire and pest management plans

Technical reviews for Environmental Impact Statements and ecological assessments

Biodiversity assessment of landholder properties for conservation planning and reserve acquisitions

Preparation and review of numerous ecological reports resulting from field surveys

Regulatory Approvals

Preparation of *EPBC Act 1999* referrals associated with threatened species and ecosystems

Regional ecosystem mapping and applications for changes and PMAVs

Assessment of projects for compliance with relevant parts of environmental legislation

Specialist Expertise

Specialist knowledge of vegetation, fauna and flora of Brigalow Belt coal seam gas fields

Threatened flora and fauna survey in southern inland Queensland

Third party technical reviews

Land Snail Expertise

1987 – current: land snail collecting throughout Australia and curation of private reference collection

1993 – 1994: Technical Assistant within Malacology Section of Queensland Museum: curation and identification of Qld and NSW land snails

1995 – current: land snail surveys of the Brigalow Belt South bioregion in Qld

Donation of >5,000 land snail specimens to Qld Museum

Relevant Publications

Eddie, C. (1992) Land snails and slugs of Booloumba Creek State Forest Park, Conondale Ranges, Southeast Queensland. *The Moreton Bay Radula* **10**(1): 6-7.

Eddie, C. (1993) Survey of land snails restricted to dry vineforests in the Lockyer Valley, Queensland. Unpublished report.

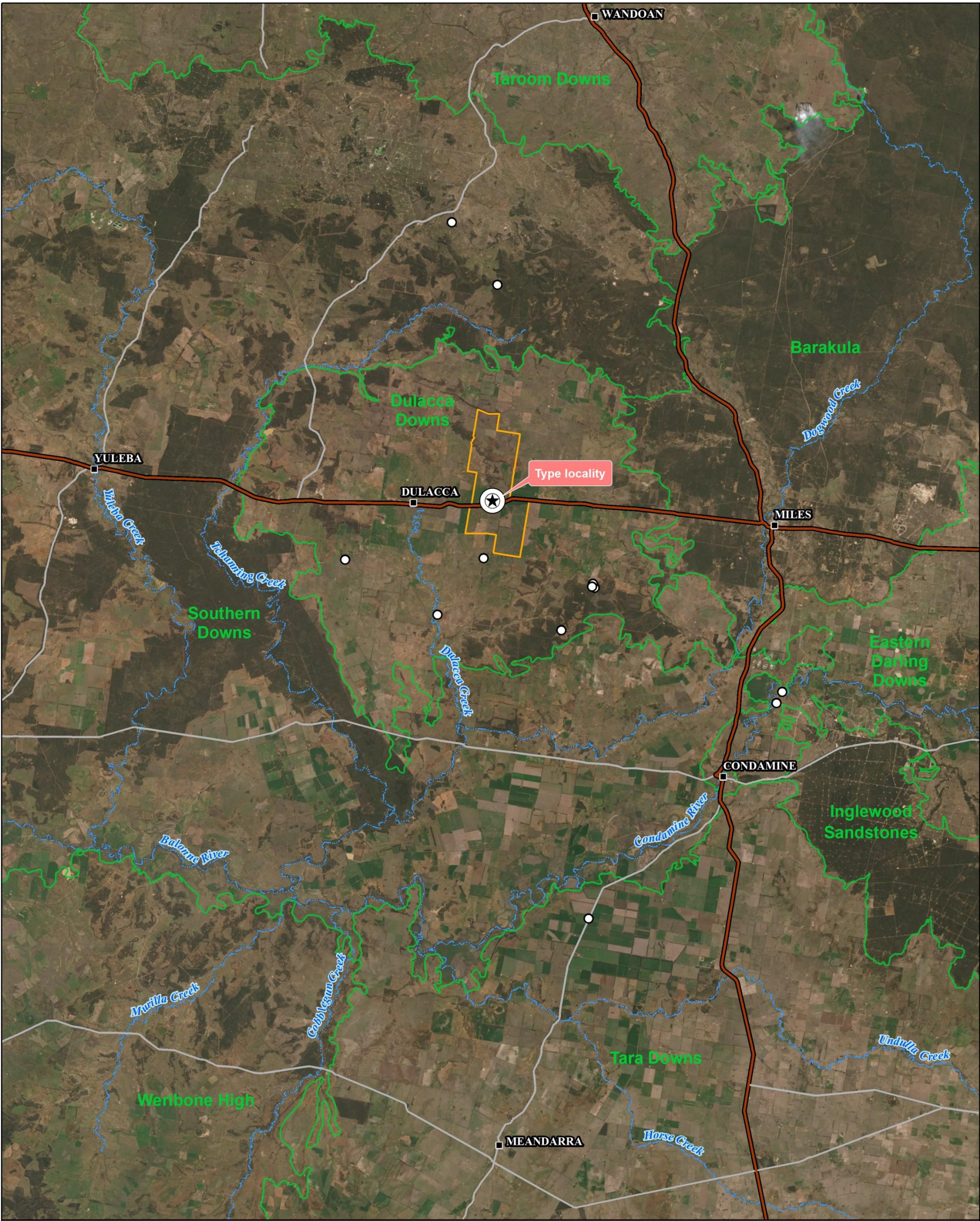
Eddie, C. (1993) Land snails of the karst limestones of the Kempsey Region, NSW. Unpublished report.

Eddie, C. (1997) A record of *Cochlicella barbara* (Linnaeus, 1758) from Queensland. *Australian Shell News* **97**: 4

Eddie, C. (2000) A new locality for the land snail genus *Elsothera* in Queensland. *Australasian Shell News* **108**: 4-5.

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Appendix C. Desktop search results for Dulacca Woodland Snail.



Appendix C. Desktop search results for Dulacca Woodland Snail.

Legend

- | | |
|---|--------------------------|
| ★ Dulacca Woodland Snail Type locality | ■ Town |
| Dulacca Woodland Snail QM / ALA Records | — Highway |
| Coordinate Precision (m) | — Main Road |
| ○ 50 | — Major watercourses |
| ○ 500 | Study Area |
| | Biogeographic Subregions |

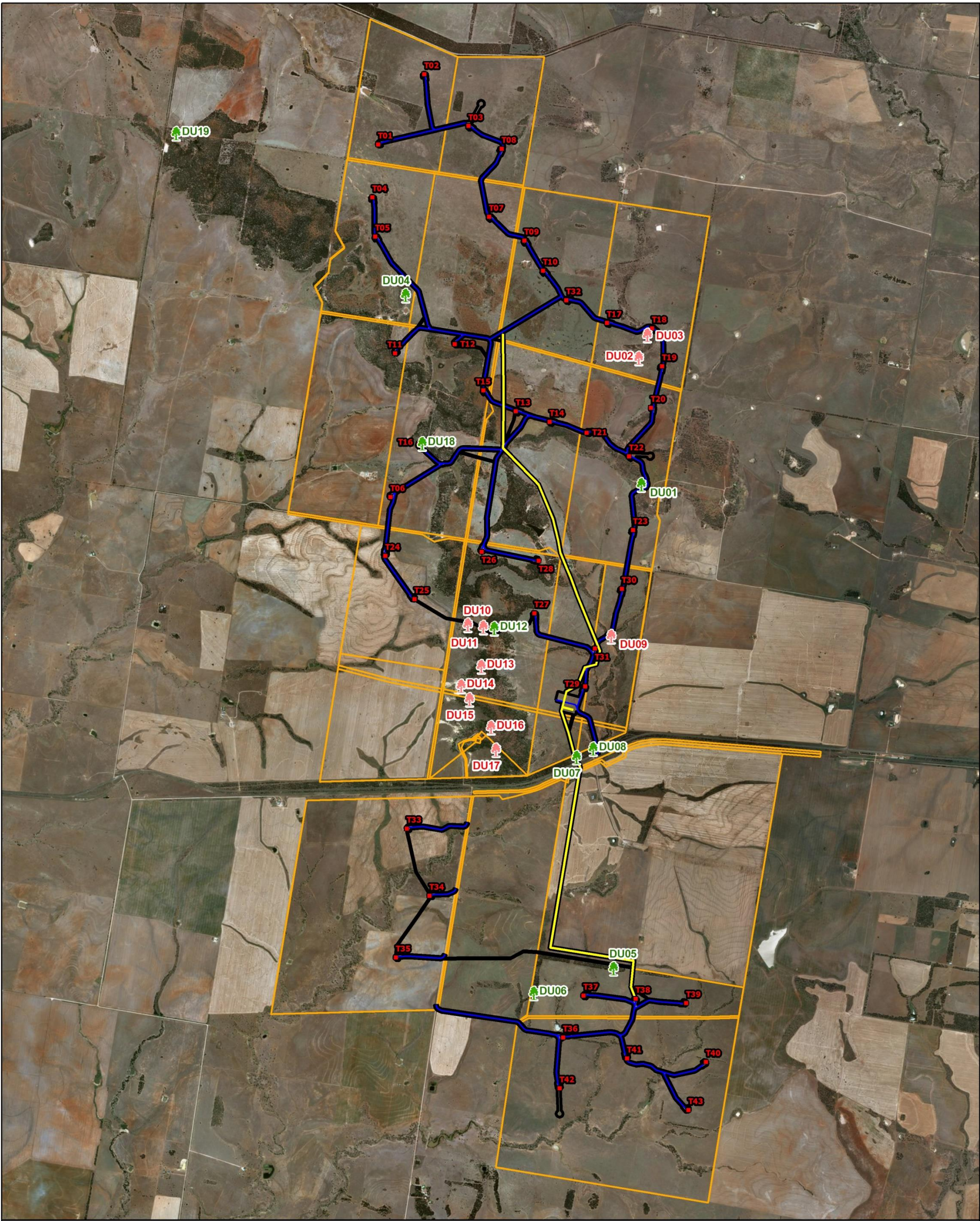
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Project: Dulacca
Snail Survey
Map No: PC701-AppC-RevC
Date: 8/11/2019
Drawn: L. Hardwick
Approved: C. Eddie
Scale: 1: 400,000 @ A3
Datum: GDA94



Appendix D. Location of Dulacca Woodland Snail survey sites within the Study Area.



Appendix D. Location of Dulacca Woodland Snail survey sites within the Study Area.

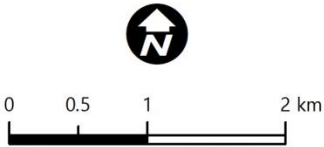
Legend

Survey Sites

- BioCondition and Search Site
- Habitat Assessment and Search Site
- Study Area
- Disturbance Footprint

Project Layout

- Turbine
- Future Overhead Line
- New Roads



Project: Dulacca
Snail Survey
Map No: PC701-AppD-RevC
Date: 10/11/2019
Drawn: L. Hardwick
Approved: C. Eddie
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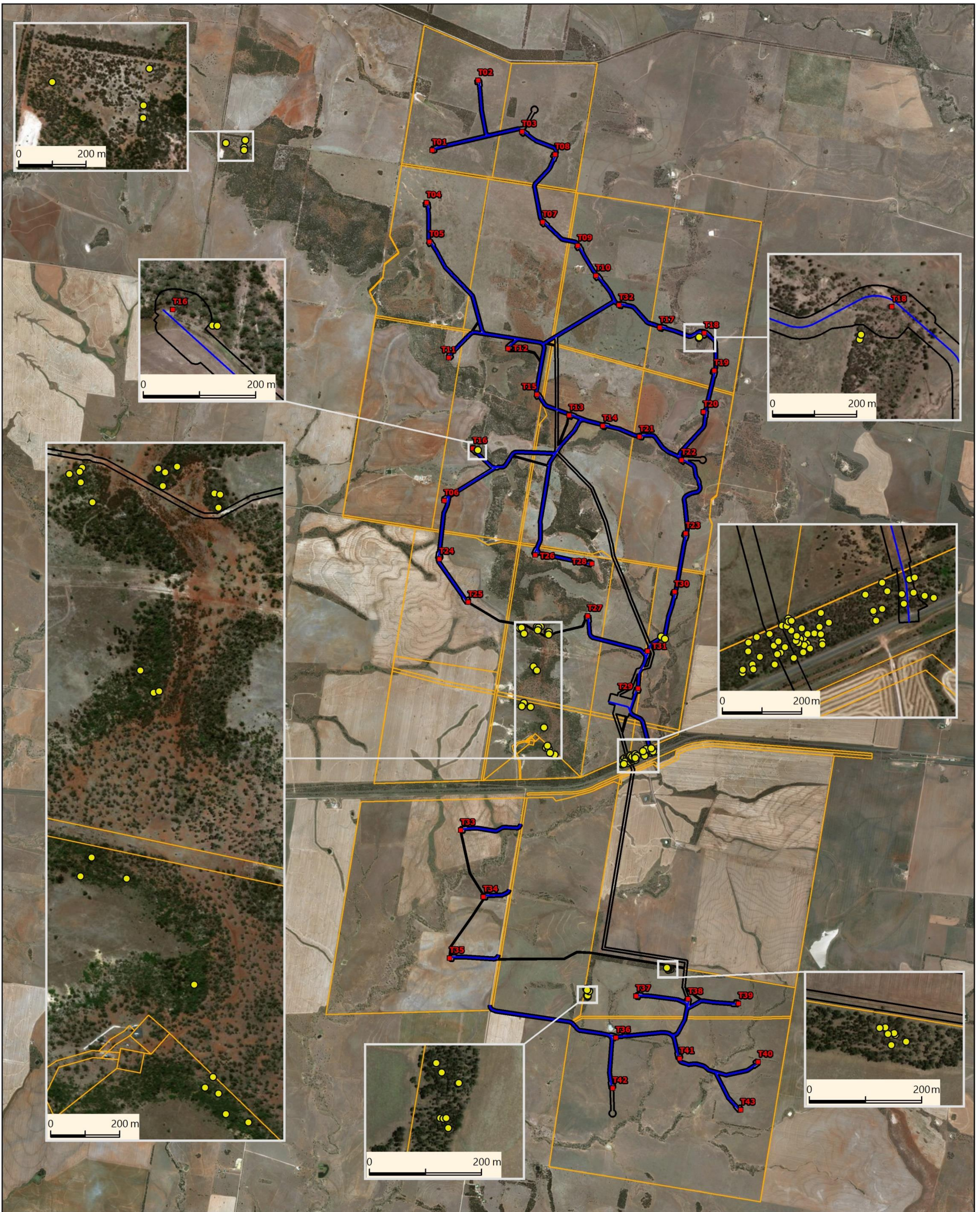
Appendix E. Characteristics of Dulacca Woodland Survey sites.

Site Code	Site Alias	Lot/Plan	Date surveyed	Search Effort (mins)	RE Code	RE Condition	Habitat Assessment Type	Site Description	Land Snail Species Recorded
DU01	Impact Area 5	68BWR258	08/10/2019	150	11.7.6	Remnant	BioCondition	<i>Eucalyptus crebra</i> woodland with scattered <i>E. exserta</i> & <i>Acacia sparsiflora</i> ; midlayer absent; sparse grassy ground layer dominated by <i>Cenchrus ciliaris</i> & <i>Ancistrachne uncinulata</i> . Ridge slope. Reddish-brown loam with surface gravel and patches of exposed rock/loose stones.	<i>Neveritis aridorum</i> , <i>Eurytrachia mucosa</i> , <i>Eremopeas tuckeri</i> , <i>Gastrocopta pediculus</i>
DU02	Habitat Map 10 (west of T19)	62BWR199	08/10/2019	70	11.7.6	Regrowth	Other	<i>Acacia tenuinervis</i> low open forest with scattered <i>Eucalyptus crebra</i> ; shrub layers absent; ground layer sparse native grasses. Undulating low hills (gentle hill slope). Reddish-brown clay loam.	<i>Neveritis aridorum</i> , <i>N. misella</i> , <i>Eremopeas tuckeri</i>
DU03	T18	62BWR199	08/10/2019	70	11.7.1	Regrowth	Other	<i>Acacia harpophylla</i> low open forest with emergent <i>E. woollsiana</i> ; shrub layer of <i>Geijera parviflora</i> , <i>Psyrax odorata</i> & <i>Carissa ovata</i> ; grassy ground layer dominated by <i>Ancistrachne uncinulata</i> . Ridge (hill slope). Brown loamy clay.	<i>Adclarkia dulacca</i> , <i>Neveritis misella</i> , <i>Eremopeas tuckeri</i> , <i>Austrosuccinea macgillivrayii</i> , <i>Pupoides pacificus</i> , <i>Gastrocopta hedleyi</i>
DU04	Offset Option C	59BWR259	09/10/2019	150	11.9.5	Regrowth	BioCondition	<i>Acacia harpophylla</i> shrubland; midlayer absent; ground layer very sparse grasses. Gently undulating plain. Brown clay. Gilgai present.	<i>Pupoides pacificus</i>
DU05	Offset Option A	2SP135608	09/10/2019	180	11.9.5	Remnant	BioCondition	<i>Acacia harpophylla</i> woodland – open forest with scattered <i>Casuarina cristata</i> ; midlayer dominated by <i>Geijera parviflora</i> , <i>Elaeodendron australe</i> , <i>Eremophila mitchellii</i> , <i>Carissa ovata</i> & <i>Rhagodia spinescens</i> ; ground layer dominated by <i>Cenchrus ciliaris</i> . Undulating low hills. Brown clay.	<i>Adclarkia dulacca</i> , <i>Neveritis misella</i> , <i>Eremopeas tuckeri</i> , <i>Gastrocopta hedleyi</i> , <i>G. pediculus</i>
DU06	Offset Option B	2SP135608	09/10/2019	130	11.9.5	Remnant	BioCondition	<i>Casuarina cristata</i> woodland – open forest with scattered <i>Acacia harpophylla</i> ; sparse midlayer dominated by <i>Geijera parviflora</i> , <i>Elaeodendron australe</i> , <i>Eremophila mitchellii</i> , <i>Carissa ovata</i> & <i>Rhagodia spinescens</i> ; ground layer dominated by <i>Cenchrus ciliaris</i> . Undulating low hills. Brown clay.	<i>Adclarkia dulacca</i> , <i>Neveritis misella</i> , <i>Eremopeas tuckeri</i> , <i>Gastrocopta hedleyi</i> , <i>G. pediculus</i> , <i>Austrosuccinea macgillivrayii</i> , <i>Eremopeas tuckeri</i>
DU07	Impact Area 2	Warrego Highway	09/10/2019, 10/10/2019	240	11.9.5	Remnant	BioCondition	<i>Acacia harpophylla</i> woodland with scattered <i>Casuarina cristata</i> ; midlayer dominated by <i>Geijera parviflora</i> , <i>Eremophila deserti</i> , <i>Carissa ovata</i> , <i>Enchylaena tomentosa</i> & <i>Rhagodia spinescens</i> ; ground layer dominated by native perennial grasses. Undulating low hills. Reddish-brown clay.	<i>Adclarkia dulacca</i> , <i>Neveritis misella</i> , <i>Eremopeas tuckeri</i> , <i>Gastrocopta hedleyi</i> , <i>G. pediculus</i> , <i>Scagacola brigalow</i> , <i>Austrosuccinea macgillivrayii</i> , <i>Pupoides pacificus</i>

Site Code	Site Alias	Lot/Plan	Date surveyed	Search Effort (mins)	RE Code	RE Condition	Habitat Assessment Type	Site Description	Land Snail Species Recorded
DU08	Impact Area 1	Warrego Highway	10/10/2019, 11/10/2019	90	11.9.5	Remnant	BioCondition	<i>Acacia harpophylla</i> woodland with scattered <i>Casuarina cristata</i> ; midlayer dominated by <i>Geijera parviflora</i> , <i>Eremophila deserti</i> , <i>E. mitchellii</i> , <i>Carissa ovata</i> & <i>Rhagodia spinescens</i> ; ground layer dominated by native perennial grasses with patches of <i>Cenchrus ciliaris</i> . Undulating low hills. Reddish-brown clay.	<i>Adclarkia dulacca</i> , <i>Neveritis misella</i> , <i>Eremopeas tuckeri</i> , <i>Gastrocopta hedleyi</i> , <i>G. pediculus</i> , <i>Scagacola brigalow</i> , <i>Austrosuccinea macgillivrayii</i> , <i>Helicarionidae</i> sp. nov., <i>Pupoides pacificus</i> , <i>Paralaoma mortii</i> , <i>Cylindrovertilla hedleyi</i>
DU09	Habitat Map 7	77BWR516	10/10/2019	90	11.9.5	Remnant	Other	<i>Acacia harpophylla</i> woodland with scattered <i>Eucalyptus populnea</i> & <i>Casuarina cristata</i> ; midlayer dominated by <i>Geijera parviflora</i> , <i>Eremophila deserti</i> & <i>Rhagodia spinescens</i> ; ground layer dominated by native perennial grasses. Gently undulating plain. Brown clay.	<i>Adclarkia dulacca</i> , <i>Neveritis misella</i> , <i>Eremopeas tuckeri</i> , <i>Gastrocopta hedleyi</i> , <i>G. pediculus</i> , <i>Scagacola brigalow</i> , <i>Helicarionidae</i> sp. nov.
DU10	Impact Area TBC (T25-27)	1SP218510	10/10/2019	90	11.7.1x1	Remnant	Other	Semi-evergreen vine thicket with scattered emergent <i>Eucalyptus crebra</i> & <i>Brachychiton rupestris</i> ; ground layer composed of <i>Cenchrus ciliaris</i> and native perennial grasses. Ridge slope. Reddish-brown loamy soil with patches of exposed surface rock.	<i>Adclarkia dulacca</i> , <i>Neveritis aridorum</i> , <i>Pallidelix chinchilla</i>
DU11	Impact Area TBC (T25-27)	1SP218510	10/10/2019	30	11.7.6	Remnant	Other	<i>Eucalyptus crebra</i> woodland with low tree layer of <i>Acacia tenuinervis</i> , <i>A. sparsiflora</i> , & <i>A. aprepta</i> ; midlayer of <i>Psyrax odorata</i> & <i>Carissa ovata</i> ; ground layer of <i>Ancistrachne uncinulata</i> . Ridge (crest). Reddish-brown loam.	<i>Adclarkia dulacca</i> , <i>Neveritis aridorum</i>
DU12	Impact Area TBC (T25-27)	1SP218510	10/10/2019	30	11.7.6	Remnant	BioCondition	<i>Eucalyptus crebra</i> woodland with low tree layer of <i>Acacia aprepta</i> ; midlayer of <i>Croton phebalioides</i> , <i>Hovea longipes</i> , <i>Psyrax odorata</i> & <i>Carissa ovata</i> ; ground layer of <i>Ancistrachne uncinulata</i> . Ridge slope. Reddish-brown loam with small surface stones.	<i>Adclarkia dulacca</i> , <i>Neveritis aridorum</i>
DU13	Habitat Map 4	1SP218510	10/10/2019	30	11.7.1x1	Remnant	Other	Semi-evergreen vine thicket with scattered emergent <i>Eucalyptus crebra</i> & <i>Brachychiton rupestris</i> ; ground layer composed of <i>Cenchrus ciliaris</i> and native perennial grasses. Ridge slope. Reddish-brown loamy soil.	<i>Adclarkia dulacca</i> , <i>Pallidelix chinchilla</i>

Site Code	Site Alias	Lot/Plan	Date surveyed	Search Effort (mins)	RE Code	RE Condition	Habitat Assessment Type	Site Description	Land Snail Species Recorded
DU14	N/A	1SP218510	10/10/2019	30	11.7.1x1	Remnant	Other	Semi-evergreen vine thicket with scattered emergent <i>Brachychiton rupestris</i> ; ground layer composed of <i>Cenchrus ciliaris</i> and native perennial grasses. Ridge slope with numerous rocks/boulders. Reddish-brown loamy soil.	<i>Eremopeas tuckeri</i> , <i>Gastrocopta hedleyi</i> , <i>G. pediculus</i> , <i>Pumilicopta bifurcata</i> , <i>Pupisoma porti</i>
DU15	Habitat Map 3	1SP218510	10/10/2019	30	11.7.1x1	Remnant	Other	Semi-evergreen vine thicket with scattered emergent <i>Brachychiton rupestris</i> ; ground layer dominated by <i>Ancistrachne uncinulata</i> . Ridge slope with numerous rocks/boulders. Reddish-brown loamy soil.	<i>Adclarkia dulacca</i> , <i>Neveritis aridorum</i> , <i>Pallidelix chinchilla</i> , <i>Eremopeas tuckeri</i> , <i>Gastrocopta hedleyi</i> , <i>G. pediculus</i>
DU16	Habitat Map 2	1SP218510	10/10/2019	30	11.7.1x1	Remnant	Other	Semi-evergreen vine thicket with scattered emergent <i>Brachychiton rupestris</i> ; ground layer dominated by <i>Ancistrachne uncinulata</i> . Ridge slope with numerous rocks/boulders. Reddish-brown loamy soil.	<i>Adclarkia dulacca</i> , <i>Eremopeas tuckeri</i> , <i>Gastrocopta hedleyi</i> , <i>G. pediculus</i>
DU17	Habitat Map 1	1SP218510	10/10/2019	30	11.7.1x1	Remnant	Other	Semi-evergreen vine thicket with scattered emergent <i>Brachychiton rupestris</i> ; ground layer composed of <i>Cenchrus ciliaris</i> and native perennial grasses. Ridge slope with numerous rocks/boulders. Reddish-brown loamy soil.	<i>Adclarkia dulacca</i> , <i>Neveritis aridorum</i> , <i>Pallidelix chinchilla</i> , <i>Scagacola brigalow</i> , <i>Eremopeas tuckeri</i> , <i>Gastrocopta hedleyi</i> , <i>G. pediculus</i>
DU18	Impact Area 3 (T16)	66BWR124	11/10/2019	180	11.7.1	Remnant	BioCondition	<i>Eucalyptus woollsiana</i> , <i>E. thozetiana</i> woodland with scattered <i>Casuarina cristata</i> & <i>E. crebra</i> ; very sparse low tree layer of <i>Acacia harpophylla</i> ; sparse shrub layer of <i>Geijera parviflora</i> , <i>Elaeodendron australe</i> , <i>Hovea longipes</i> & <i>Olearia canescens</i> ; ground layer dominated by <i>Ancistrachne uncinulata</i> . Ridge slope. Brown clay loam with small surface stones.	<i>Adclarkia dulacca</i> , <i>Eurytrachia mucosa</i>
DU19	Offset Area D	57BWR199	11/10/2019	150	11.9.1	Regrowth	BioCondition	<i>Acacia harpophylla</i> shrubland with scattered <i>Eucalyptus thozetiana</i> ; very sparse ground layer composed of <i>Cenchrus ciliaris</i> & native perennial grasses. Gently undulating plain. Reddish-brown clay with surface pea gravel. Gilgai present.	<i>Adclarkia dulacca</i> , <i>Neveritis misella</i> , <i>N. aridorum</i> , <i>Eremopeas tuckeri</i> , <i>Gastrocopta hedleyi</i> , <i>G. pediculus</i> , <i>Scagacola brigalow</i> , <i>Eurytrachia mucosa</i>

Appendix F. Location of Dulacca Woodland Snails detected during the
survey.

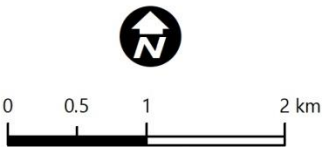


Appendix F. Location of Dulacca Woodland Snails detected during the survey.

Legend

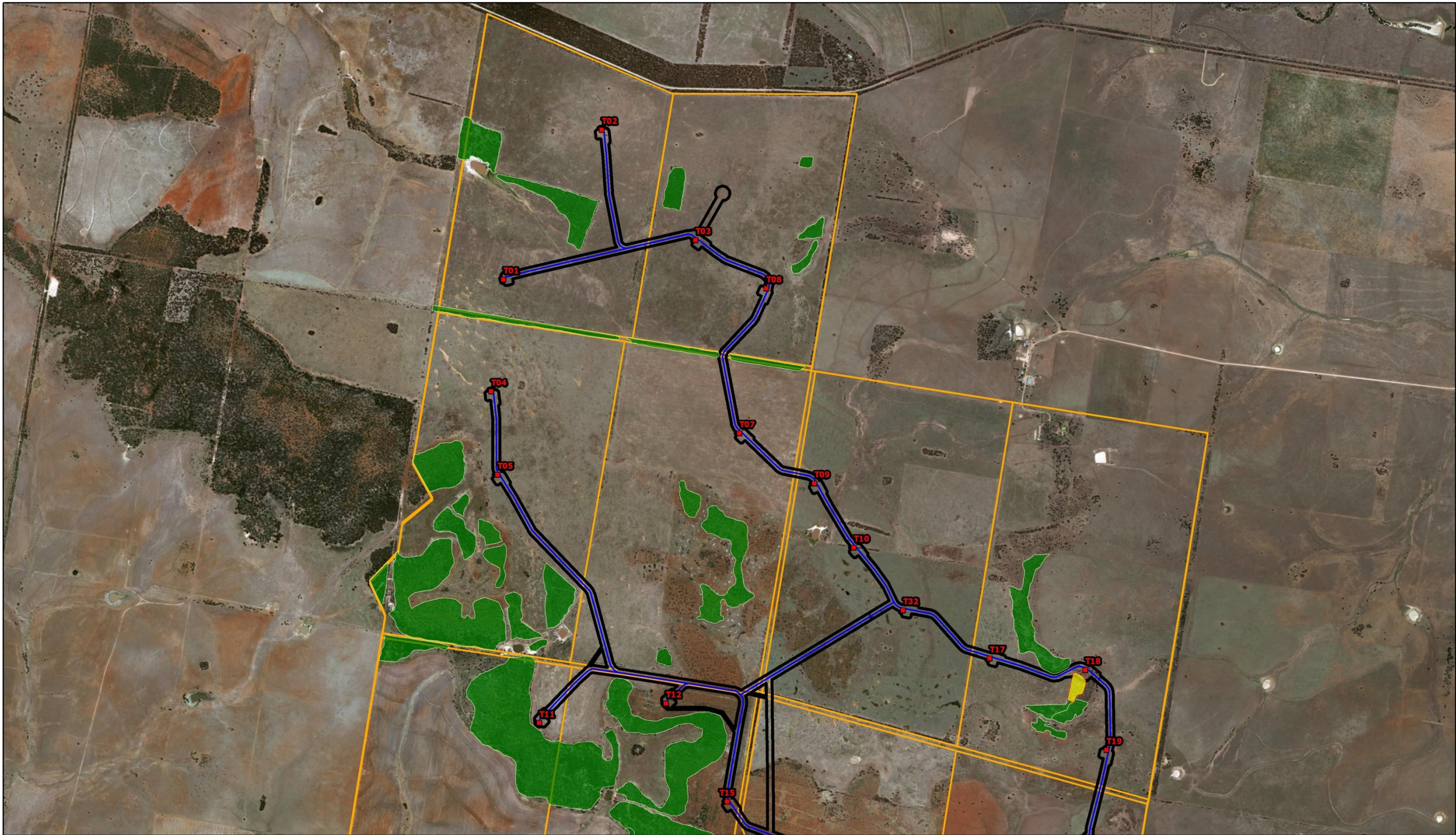
- | | |
|--------------------------|-----------------------|
| ● Dulacca Woodland Snail | Project Layout |
| Study Area (Cadastre) | ■ Turbine |
| Disturbance Footprint | — New Road |

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 Map No: PC701-AppF-RevC
 Date: 10/11/2019
 Drawn: L. Hardwick
 Approved: C. Eddie
 Scale: 1: 50,000 @ A3
 Datum: GDA94



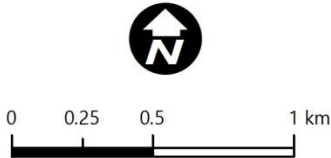


Appendix G1. Refined habitat mapping for Dulacca Woodland Snail.

Legend

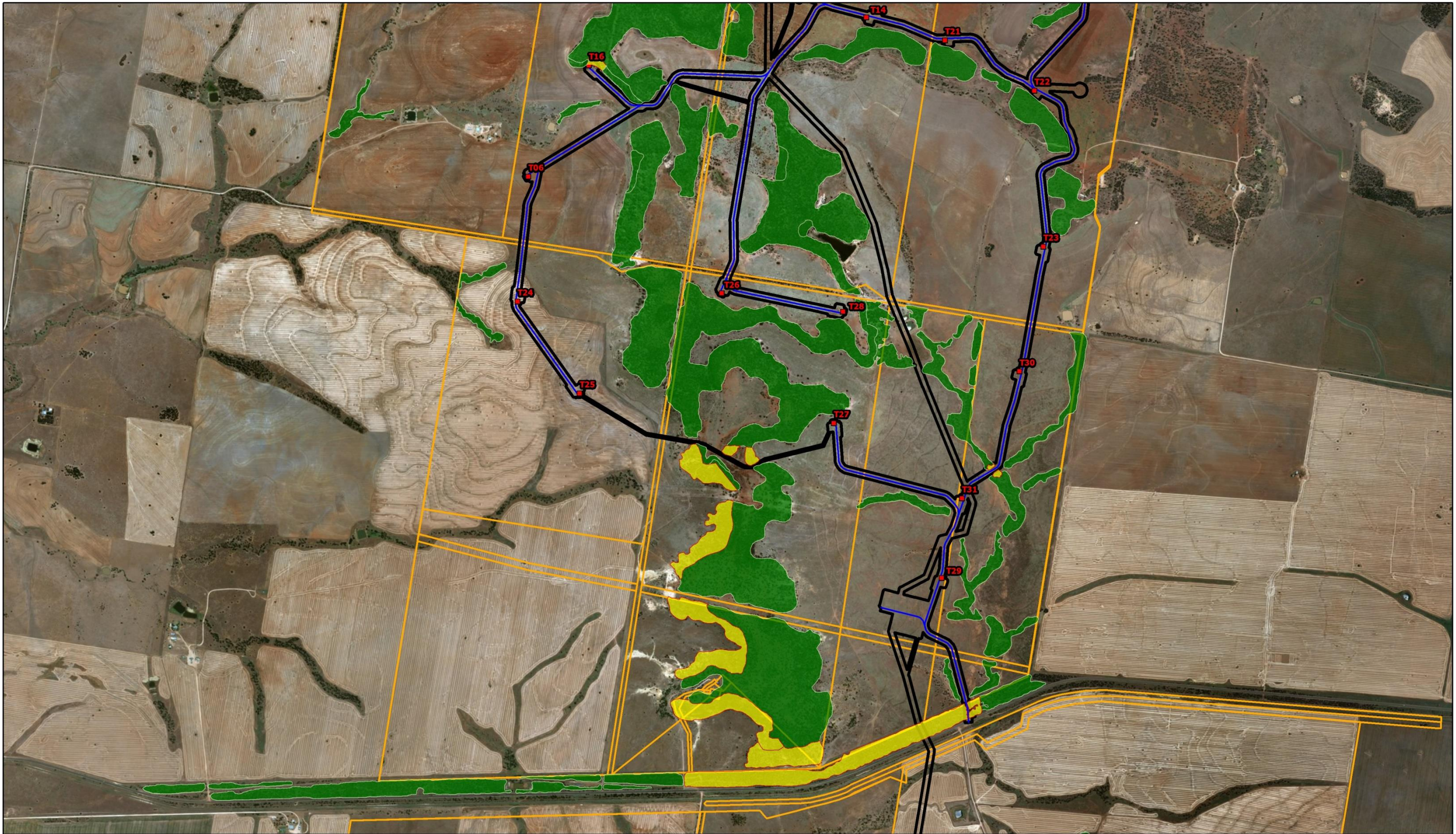
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|---------------------------------------|-----------------------|-----------------------|
| Dulacca Woodland Snail Habitat | Study Area | Project Layout |
| Confirmed | Disturbance Footprint | Turbine |
| Potential | | New Roads |

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 Snail Survey
 Map No: PC701-AppG1-RevC
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 Approved: C. Eddie
 Scale: 1: 24,500 @ A3
 Datum: GDA94



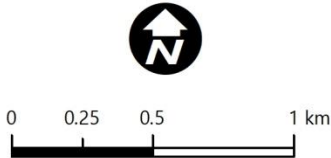


Appendix G2. Refined habitat mapping for Dulacca Woodland Snail.

Legend

- | | | |
|---------------------------------------|-----------------------|-----------------------|
| Dulacca Woodland Snail Habitat | Study Area | Project Layout |
| Confirmed | Disturbance Footprint | Turbine |
| Potential | | New Roads |

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Project: Dulacca
Snail Survey

Map No: PC701-AppG2-RevC

Date: 10/11/2019

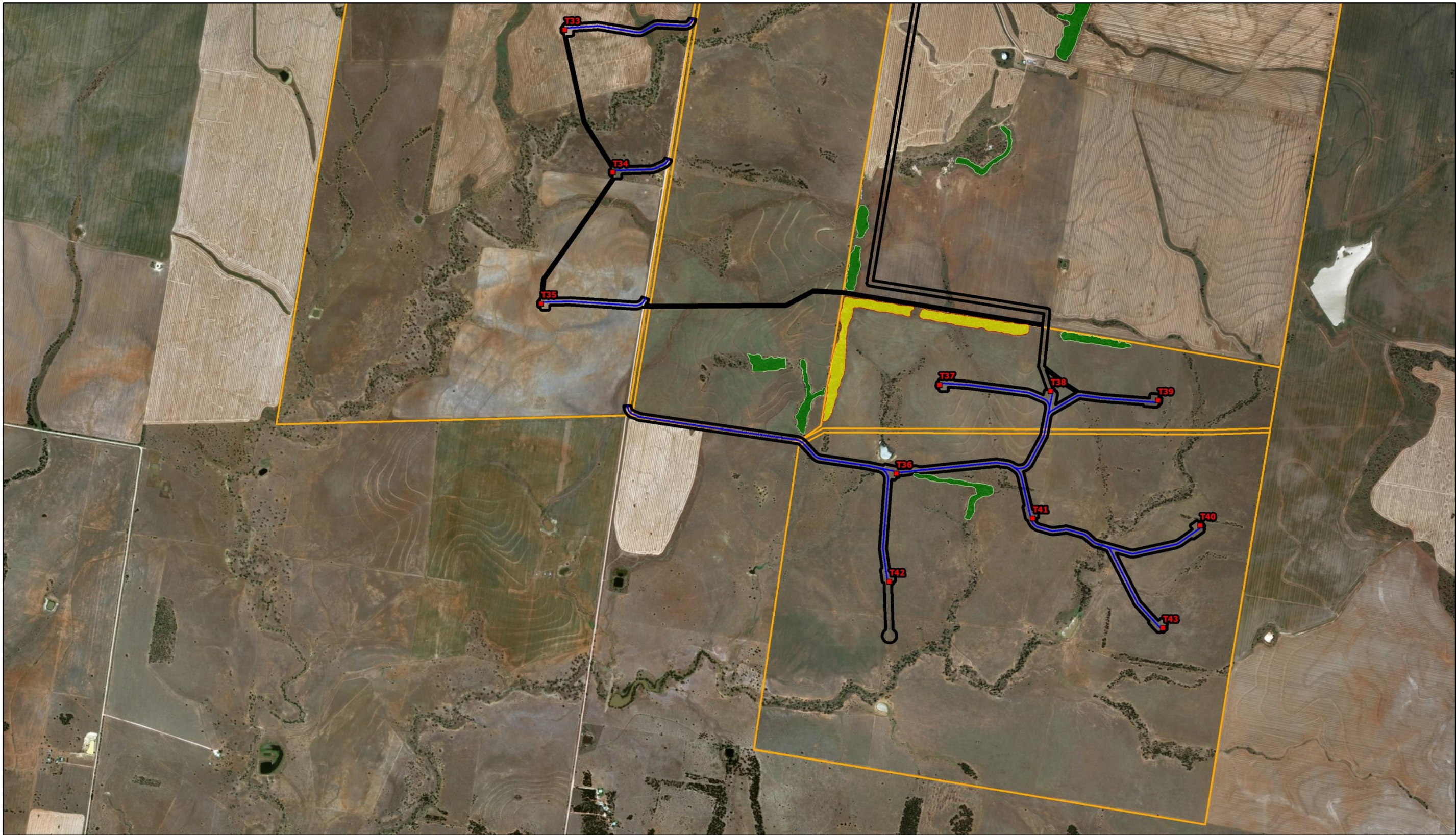
Drawn: L. Hardwick

Approved: C. Eddie

Scale: 1: 24,500 @ A3

Datum: GDA94



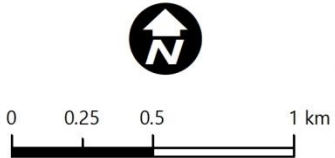
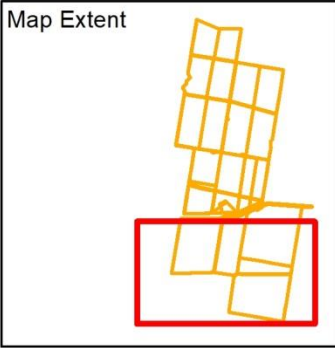


Appendix G3. Refined habitat mapping for Dulacca Woodland Snail.

Legend

- | | | |
|---|---|---|
| Dulacca Woodland Snail Habitat |  Study Area | Project Layout |
|  Confirmed |  Disturbance Footprint |  Turbine |
|  Potential | |  New Roads |

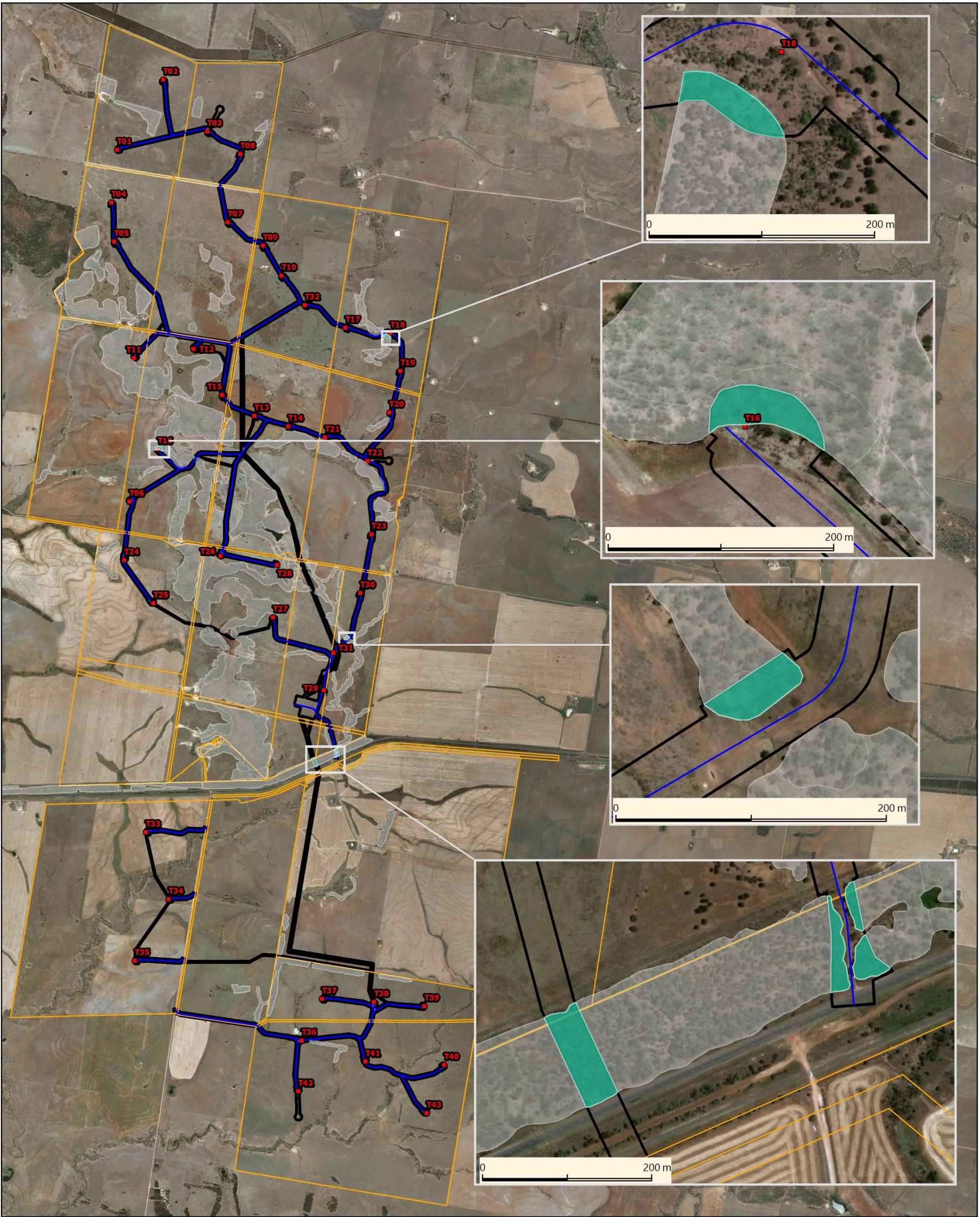
BOOBOOK gives no warranty in relation to the data in this map (including accuracy, reliability, completeness or suitability) and accepts no liability for any loss, damage or costs (including consequential damage) relating to any use of this data.
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.




Project: Dulacca
Snail Survey
Map No: PC701-AppG3-RevC
Date: 10/11/2019
Drawn: L. Hardwick
Approved: C. Eddie
Scale: 1: 24,500 @ A3
Datum: GDA94



Appendix H. Location of Potential Clearing Areas within the Project Layout.



Appendix H. Location of Potential Clearing Areas within the Disturbance Footprint.

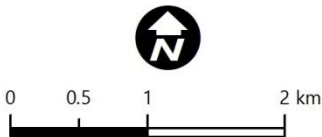
Legend

- Potential Clearing Impact Area
- Dulacca Woodland Snail Habitat
- Study Area
- Disturbance Footprint

Project Layout

- Turbine
- New Road

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 National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, Increment P Corp.



Project: Dulacca
Snail Survey

Map No: PC701-AppH-RevC

Date: 10/11/2019

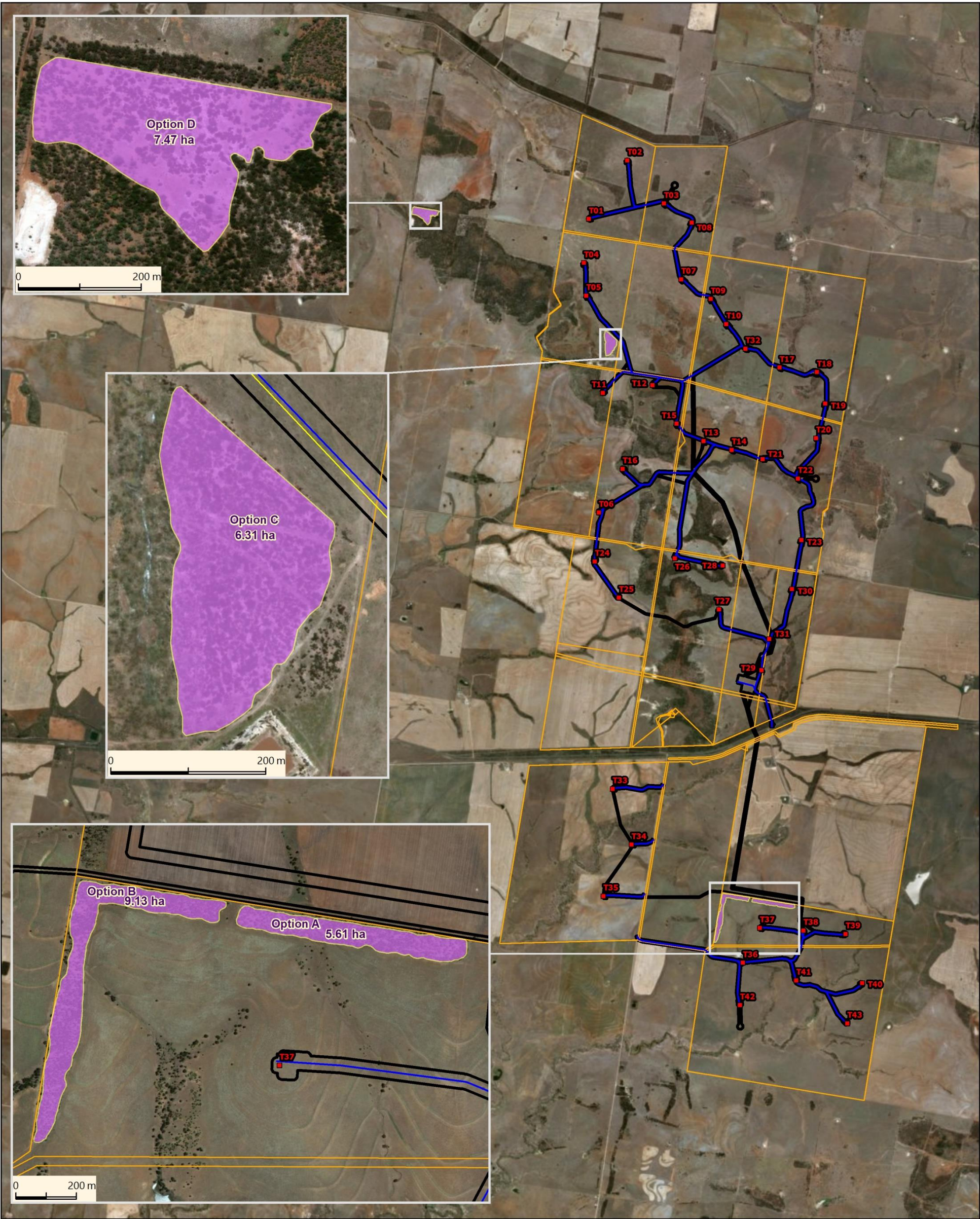
Drawn: L. Hardwick

Approved: C. Eddie

Scale: 1: 50,000 @ A3

Datum: GDA94

Appendix I. Location of Potential Offset Areas.

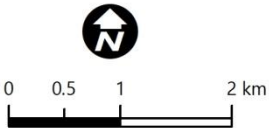


Appendix I. Location of Potential Offset Areas.

Legend

- | | |
|---|--|
| Potential Offset Area | Project Layout |
| Indicative Extent | Turbine |
| Study Area | New Road |
| Disturbance Footprint | |

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 National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.



Boobook

Project: Dulacca
 Snail Survey
 Map No: PC701-AppI-RevC
 Date: 10/11/2019
 Drawn: L. Hardwick
 Approved: C. Eddie
 Scale: 1: 60,000 @ A3
 Datum: GDA94



Appendix C

Modelled offset quality
scenarios

Appendix C Modelled offset quality scenarios

Modelled quality scenario without offset

The table below outlines the predicted results and associated scores from ongoing clearing and grazing of the proposed offset site (altered values shaded and bolded). It is anticipated that the following quality attributes will be affected:

- Site condition:
 - trees species diversity: removal of tree species during clearing
 - canopy height and cover: removal of canopy layer during clearing
 - coarse woody debris: reduction of fallen woody debris as a result of clearing practices
 - weed cover: increase in weed incursion due to lack of canopy cover and increased grazing
- Site context: no anticipated changes as surrounding areas are protected from clearing
- Species stocking rates:
 - Presence and abundance: areas of habitat lost due to clearing and grazing (loss of necessary microhabitat and microclimate required to support the species), which results in a lower carrying capacity and reduced population numbers
 - Role of the site to species overall population in state: reduction in the carrying capacity as a result of habitat loss reducing the viability of the area in maintaining a population.

Offset Site			
Assessment unit	4		
Site	Benchmark	DU19	
RE	11.9.1		
Condition	Regrowth		
Field based attributes (site condition)			
	Benchmark values	Raw	Score
Recruitment of woody perennial species	100	100	5
Native plant species richness			
Trees	4	0	0
Shrubs	9	3	2.5
Grasses	10	1	0
Forbs	7	3	2.5
Tree Canopy Height	14	0	0
Tree Canopy Cover	40	0	0
Shrub canopy cover	16	2.1	3
Native perennial grass cover	16	0.4	0
Organic litter cover	35	50	5
Large trees	13	0	0
Coarse woody debris	565	250	2

Offset Site			
Assessment unit	4		
Weed cover		25	3
Total Field based attributes			23
GIS based attributes (site context)			
Fragmented - Patch size			7
Fragmented - Connectivity			5
Fragmented - Context			4
Ecological Corridors			0
Total GIS attributes			16
Total BioCondition Score			39
Species Index Scoring – Dulacca Woodland Snail (species stocking rate)			
Presence / abundance			5
Threat to species			1
Quality and availability of food and foraging habitat			5
Quality and availability of shelter			5
Species mobility capacity			1
Role of site location to overall population in state			1
Total Species Habitat Score			18
Habitat Quality Score (measured)		57	
Habitat Quality Score (max)		171	
Average Assessment Unit Habitat Quality Score (out of 10)		3.33	
Habitat quality score for all assessment units combined	3		

Modelled quality scenario with offset

The table below outlines the predicted results and associated scores from the implementation of management measures and the prohibition of clearing activities within the proposed offset site (altered values shaded and bolded). It is anticipated that the following quality attributes will be affected:

- Site condition:
 - grass species diversity: stock management and prohibition of clearing allowing natural regeneration
 - canopy height: prohibition of clearing allowing natural regeneration
 - native perennial grass cover: stock management and prohibition of clearing allowing natural regeneration
- Site context: no anticipated changes as surrounding areas are protected from clearing
- Species stocking rates:
 - Threat to species: key threatening processes identified for the species will be controlled i.e. land clearing / habitat loss, invasion of buffel grass, trampling by cattle, high intensity fires, pest incursion
 - Quality and availability of shelter and species mobility capacity: reduction of threats will result in the improvement and increase in these values

Offset Site			
Assessment unit	4		
Site	Benchmark	DU19	
RE	11.9.1		
Condition	Regrowth		
Field based attributes (site condition)			
	Benchmark values	Raw	Score
Recruitment of woody perennial species	100	100	5
Native plant species richness			
Trees	4	2	2.5
Shrubs	9	3	2.5
Grasses	10	3	2.5
Forbs	7	3	2.5
Tree Canopy Height	14	10	5
Tree Canopy Cover	40	39.2	5
Shrub canopy cover	16	2.1	3
Native perennial grass cover	16	8	3
Organic litter cover	35	50	5
Large trees	13	0	0
Coarse woody debris	565	300.8	5
Weed cover		0.1	10
Total Field based attributes			51
GIS based attributes (site context)			
Fragmented - Patch size			7
Fragmented - Connectivity			5
Fragmented - Context			4
Ecological Corridors			0
Total GIS attributes			16
Total BioCondition Score			67
Species Index Scoring – Dulacca Woodland Snail (species stocking rate)			
Presence / abundance			10
Threat to species			10
Quality and availability of food and foraging habitat			5
Quality and availability of shelter			10
Species mobility capacity			7
Role of site location to overall population in state			4
Total Species Habitat Score			46

Offset Site		
Assessment unit	4	
Habitat Quality Score (measured)		113
Habitat Quality Score (max)		171
Average Assessment Unit Habitat Quality Score (out of 10)		6.61
Habitat quality score for all assessment units combined	7	

Appendix D

Weed treatment and
control methods

Appendix D Weed treatment and control methods

Table 13 Weed treatment and control methods for invasive plants likely to occur within the offset area

Species	Image	Description	Preferred control method	Published guideline
Mother of millions <i>Bryophyllum delagoense</i> Restricted Matter (Biosecurity Act 2014) Western Downs Priority Pest Plant		A long-lived (i.e. perennial) fleshy (i.e. succulent) plant with upright (i.e. erect) stems usually growing 30-180 cm tall, but occasionally reaching up to 2.5 m or more in height. Distinguishing features: • a fleshy herbaceous plant with upright stems growing 30-180 cm tall. • its mottled leaves are cylindrical and have a few small 'teeth' near their tips. • tiny plantlets are often produced at the tips of its leaves. • its drooping bell-shaped flowers (2-4 cm long) are usually red or reddish-pink in colour. • these flowers are borne in dense clusters at the top of its stems.	Manual removal (i.e. hand pulling or grubbing using a hand tool) can be undertaken for this species if there are only very sparse weeds present, if the area is sensitive habitat (i.e. confirmed Dulacca woodland snail or Belson panic habitat) or if the soil is sandy or loose where the plant can be pulled with the root intact. Care must be taken when using this method as plantlets can detach from the leaves during removal and establish new plants. Some regrowth will therefore occur, and follow-up treatment may be required. For larger infestations and/or where the soil precludes hand pulling, direct spot spraying with herbicide is recommended. Spot spraying involves a knapsack filled with a herbicide mix used by an operator to selectively control weeds. A keen eye and an ability to distinguish between native and weed species is essential.	https://www.daf.qld.gov.au/_data/assets/pdf_file/0018/61461/Mother-Millions-PP33.pdf

Species	Image	Description	Preferred control method	Published guideline
			Marker dye is added to the mix to allow the operator to see what has already been sprayed, in addition to the addition of a penetrant and/or surfactant. Herbicide: Metsulfuron methyl (1.5g Metsulfuron methyl: 10L water + surfactant + colour marking dye)	
Velvety prickly pear <i>Opuntia tomentosa</i> Restricted Matter (Biosecurity Act 2014) Western Downs Priority Pest Plant	 	An upright (i.e. erect), fleshy (i.e. succulent), tree-like plant usually growing 2-6 m tall, but occasionally reaching up to 8 m in height. Distinguishing features: - an upright, fleshy, tree-like plant (growing up to 8 m tall) with a single woody main stem at its base. - its stems are much-branched and consist of a series of flattened segments. - these stem segments are covered in fine hairs and bear small	Spot spray or cut-scrape-paint in horizontal cuts across flat stem. Manual removal (i.e. hand pulling or grubbing using a hand tool) can be undertaken for this species if the plant is a small specimen (e.g. shrub size), there are only very sparse weeds present and if the soil is sandy or loose where the plant can be pulled with the root intact. Spot spraying involves a knapsack filled with a herbicide mix used by an operator to selectively control weeds. A keen eye and an ability to distinguish between native and weed species is essential. Marker dye is added to the mix to allow the operator to see what has already been sprayed, in additional	https://www.daf.qld.gov.au/_data/assets/pdf_file/0008/383822/Opuntia-id-cacti.pdf

Species	Image	Description	Preferred control method	Published guideline
		raised structures that are usually spineless. - its orange flowers have reddish markings on the outermost 'petals'. - the fleshy fruit (about 50 mm long and 35 mm wide) turn dull red in colour as they mature.	to the addition of a penetrant and/or surfactant. The cut-scrape-paint technique for this species should be done in horizontal cuts across the flat stems. Then apply herbicide to the cut stems. Herbicide: - Spot spray: Glyphosate + Metsulfuron Mythyl (100ml Gly + 1.5MM in 10L water + surfactant + colour marking dye). - Cut-scrape-paint: Glyphosate + Metsulfuron Mythyl (1g MM added to 1 Gly: 1.5 water).	
Prickly pear <i>Opuntia stricta</i> Restricted Matter (Biosecurity Act 2014) Western Downs Priority Pest Plant		An upright (i.e. erect) or spreading fleshy (i.e. succulent) shrub usually growing 50-100 cm tall, but occasionally reaching up to 2 m in height. Distinguishing Features: - an upright or spreading fleshy shrub usually growing only 50-100 cm tall. - its stems are much-branched and consist	Spot spray or cut-scrape-paint in horizontal cuts across flat stem. Manual removal (i.e. hand pulling or grubbing using a hand tool) can be undertaken for this species if the plant is a small specimen (e.g. shrub size), there are only very sparse weeds present and if the soil is sandy or loose where the plant can be pulled with the root intact. Spot spraying involves a knapsack filled with a herbicide mix used by an operator to selectively control	https://www.daf.qld.gov.au/_data/assets/pdf_file/0008/383822/Opuntia-id-cacti.pdf

Species	Image	Description	Preferred control method	Published guideline
		of a series of flattened fleshy segments. - these stem segments are longer than they are broad and have groups of one or two sharp spines (2-4 cm long). - its showy yellow flowers (6-8 cm across) are borne along the margins of the stem segments and the fleshy fruit turn reddish-purple in colour as they mature. - its fruit (4-8 cm long and 3-4 cm wide) are egg-shaped and have several tufts of small barbed bristles on their surface.	weeds. A keen eye and an ability to distinguish between native and weed species is essential. Marker dye is added to the mix to allow the operator to see what has already been sprayed, in addition to the addition of a penetrant and/or surfactant. The cut-scrape-paint technique for this species should be done in horizontal cuts across the flat stems. Then apply herbicide to the cut stems. Herbicide: - Spot spray: Glyphosate + Metsulfuron Mythyl (100ml Gly + 1.5MM in 10L water + Additive and Colour marking dye). - Cut-scrape-paint: Glyphosate + Metsulfuron Mythyl (1g MM added to 1 Gly: 1.5 water).	

Appendix E

Definitions from EPBC
Act Approval

Appendix E – Relevant EPBC Act Approval Definitions

Benchmark means the quantitative value for the relevant BioCondition attribute specified for each **Regional Ecosystem** by the Queensland Herbarium, as described in the BioCondition Benchmarks for the Brigalow Belt Bioregion (10/1/2019) or a subsequent version approved by the Queensland Government).

Biodiversity Offset Plan (BOP) means the Dulacca Renewable Energy Project – Biodiversity Offset Plan, version currently approved by the **Minister** in writing¹.

business days means a day that is not a Saturday, a Sunday or a public holiday in the state or territory of the action.

Clear/cleared/clearing/clearance means the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of vegetation (but not including **weeds** – see the Australian weeds strategy 2017 to 2027 for further guidance).

Commencement of the action/commence the action means the first instance of any specified activity associated with the action including **clearing** and **construction**. **Commencement of the action/commence the action** does not include minor physical disturbance necessary to:

- (a) undertake geotechnical surveys, pre-clearance surveys, monitoring programs, and weed management activities under condition 5(a);
- (b) install signage and/or temporary fencing to prevent unapproved use of the project site (as defined in the **preliminary documentation**); and
- (c) protect environmental and property assets from fire, **weeds** and pests, including maintenance or use of existing surface access tracks.

Construction/ed means the erection of a building or structure that is or is to be fixed to the ground and wholly or partially fabricated on-site; the alteration, maintenance, repair or demolition of any building or structure; preliminary site preparation work which involves breaking of the ground; the laying of pipes and other prefabricated materials in the ground, and any associated excavation work; but excluding geotechnical surveys, pre-clearance surveys, the installation of temporary fences and signage, and measures required to protect environmental and property assets from fire, weeds and pests, including maintenance or use of existing surface access tracks.

Department means the Australian Government agency responsible for administering the **EPBC Act**.

Dulacca Woodland Snail means the Dulacca Woodland Snail (*Adclarkia dulacca*) listed as a threatened species under the **EPBC Act**.

Dulacca Woodland Snail habitat means any vegetation that provides habitat suitable for the **Dulacca Woodland Snail**, including the **Regional Ecosystem** 11.9.1, or as described in the Conservation Advice *Adclarkia dulacca* Dulacca woodland snail (2016). **Dulacca Woodland Snail habitat** within the **project area** is shown in Appendix B of the EPBC Act Approval.

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

¹ The definition in the EPBC Act Approval includes a specific revision number and date. For the purpose of this document, the definition has been worded to state the version currently approved by the Minister in writing.

EPBC Act listed migratory species means the migratory fauna species listed under the **EPBC Act** for which this approval has effect, including:

- (a) Fork-tailed Swift (*Apus pacificus*); and/or
- (b) White-throated Needletail (*Hirundapus caudacutus*).

EPBC Act listed threatened species means the threatened flora and fauna species listed under the **EPBC Act** for which this approval has effect, including:

- (a) Dulacca Woodland Snail (*Adclarkia dulacca*); and/or
- (b) White-throated Needletail (*Hirundapus caudacutus*).

First full operation means the first date the electricity network operator allows all Dulacca Renewable Energy Project wind turbines to simultaneously operate and export electricity up to the maximum output.

Hermitage Property Offset area means the offset site proximate to the **project area** that contains suitable values and can wholly and effectively accommodate the offset obligation, as specified in the **BOP**.

Impact/s/ed (verb) means to cause any measurable direct or indirect disturbance or harmful change as a result of any activity associated with the action. **Impact** (noun) means any measurable direct or indirect disturbance or harmful change as a result of any activity associated with the action.

Independent means a person(s) that does not have an individual or by employment or family affiliation, any conflicting or competing interests with the approval holder; the approval holder's staff, representatives or associated persons; or the project, including any personal, financial, business or employment relationship, other than receiving payment for undertaking the role for which the condition requires an independent person.

Legally secure/d/ing means to secure a legal agreement under relevant Queensland legislation, in relation to a site, to provide enduring protection for the site against development incompatible with conservation.

Minister means the Australian Government Minister administering the **EPBC Act** including any delegate thereof.

Modelled quality scenario with offset means the modelled quality scenario with offset predicted results and associated scores as listed in Appendix C of the **BOP**.

Operation means all activities required to facilitate the generation of electricity from the wind farm occurring subsequent to the **first full operation** of the wind farm.

Preliminary documentation means the Dulacca Renewable Energy Project EPBC 2018/8368 - Preliminary documentation, dated 29 May 2020.

Project area means the total area where the construction and operation of the action will be undertaken, labelled as 'study area' in Appendix A of the EPBC Act Approval.

Regional Ecosystem means a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil as classified by the Queensland Government under the *Vegetation Management Act 1999* (Qld).

Shapefile means location and attribute information of the action provided in an Esri shapefile format. Shapefiles must contain '.shp', '.shx', '.dbf' files and a '.prj' file that specifies the projection/geographic

coordinate system used. Shapefiles must also include an '.xml' metadata file that describes the shapefile for discovery and identification purposes.

Species stocking rate means the usage and/or density of the **Dulacca Woodland Snail** at the **Hermitage Property Offset area** as identified within the modelled offset quality scenarios within the **BOP**.

Suitably qualified ecologist means a person who has professional qualifications and at least three years of work experience designing and implementing surveys for the **EPBC Act listed threatened species** and/or **EPBC Act listed migratory species** and their habitat, and can give an authoritative **independent** assessment and advice on the presence and habitat requirements of the **EPBC Act listed threatened species** and/or **EPBC Act listed migratory species** using relevant protocols, standards, methods and/or literature.

Vegetation and Fauna Management Plan means the Dulacca Renewable Energy Project – Vegetation and Fauna Management Plan, version currently approved by the **Minister** in writing².

Website means a set of related web pages located under a single domain name attributed to the approval holder and available to the public.

Weed means the invasive weeds specified in the **Vegetation and Fauna Management Plan**.

Year 5 means the period within five years from the date of the **commencement of the action**.

Year 10 means the period within ten years from the date of the **commencement of the action**.

Year 15 means the period within fifteen years from the date of the **commencement of the action**.

Year 20 means the period within twenty years from the date of the **commencement of the action**.

² The definition in the EPBC Act Approval includes a specific revision number and date. For the purpose of this document, the definition has been worded to state the version currently approved by the Minister in writing.